

Review of ATP's Investment Strategy

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Part I

Mandate and executive summary

Chapter 1

Mandate

Key message

Our mandate in the Evaluation Group is to evaluate ATP's investment strategy, taking the legal and Supervisory Board-established conditions regarding the design of the product as given. The investment decisions made by the Supervisory Board fall within our remit. As the product design has implications for the investment strategy, we will comment on the design but refrain from making recommendations in this area. We have also been asked to make suggestions regarding the communication of ATP's value creation.

The Supervisory Board has additionally asked us to consider unintended consequences of the product design, the appropriate investment strategy and asset allocation for ATP Lifelong Pension, and the complexity of the current portfolio and mandate structure; we have treated these as input to the direction of our work rather than as questions requiring separate answers.

Our reporting was due to ATP no later than June 2026 and must preserve the confidentiality of ATP's ongoing investment business. The mandate is attached as Appendix [A](#).

Our mandate in the Evaluation Group¹ is to evaluate ATP's investment strategy, taking the legal and Supervisory Board-established conditions regarding the design of the product as given. The investment decisions made by the Supervisory Board fall within our remit. As the product design has implications for the investment strategy, we will comment on the design but refrain from making recommendations in this area. We have also been asked to make suggestions regarding the communication of ATP's value creation.

We are free to evaluate all investment elements and choices made within the legal framework;

¹Biographies of the members of the Evaluation Group are provided in Appendix [B](#).

this includes assessment of choices made and any suggestions for changes (either substantive changes or suggestions for simplification or further delineation). In addition to the above evaluation, we have been asked to provide a perspective on past performance, while also assessing how performance can best be put into perspective going forward. The evaluation shall take the legal and Supervisory Board-established conditions regarding the design of the product as given. The design of the pension product refers to the overall design of the ATP product, including, for example, the guarantee element and the length of the interest guarantees provided, as these elements are determined in relation to the overall pension system in Denmark.

While we acknowledge the limitations in terms of both the restrictions imposed by the legislation and the decisions on the design of the product made by the Supervisory Board, we do address the product design's implications for investment decisions. Investment decisions made by the Supervisory Board thus fall within the scope of our assessment. This also includes how the Supervisory Board choices relate to the ATP Act. For example, the investment strategy has to be assessed based on ATP's legal obligation to provide a guaranteed pension and the choice of inflation indexing objective. We refrain from making recommendations in relation to product design itself.

Furthermore, we have been asked to make suggestions for a future communication focus, including supplementary key figures for the ongoing value creation in ATP's pension product. ATP's pension product is a guaranteed and lifelong pension, the inherent purpose of which is long-term value creation. The design of the product means that the main value creation in the product—the return on the guarantees provided—is not reflected in the financial statements. The focus in communication typically only becomes the result of the Investment Portfolio, which constitutes a smaller part of the assets under management and only contributes to part of the overall value creation, which includes the value creation from the guarantees. We have been asked to make suggestions on how the overall value creation of the ATP product can be illustrated and communicated in future financial statements, possibly using new key figures.

Besides the directions given by the mandate (see Appendix A), ATP's Supervisory Board has asked us to investigate some additional topics and questions. One of these relates to whether there are any features of the overall design of the ATP product—while still taking it as given—that have unintended consequences or costs for ATP. The request also includes a general assessment of complexity in the overall setup with five portfolios and in the underlying setup, including the division of internal mandates, external mandates, and subsidiaries. We have treated these additional questions as input to the direction of our work, rather than questions that need to be explicitly answered.

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Our mandate set both a delivery deadline and a constraint on what the published report may disclose. The evaluation was due to ATP as soon as possible and no later than June 2026, and the main conclusions and recommendations were published in that month. Publication must not disadvantage ATP's investment business, so that ongoing asset management and trade execution can continue to be carried out effectively and confidentially.

We have accordingly refrained from reporting individual positions and transaction details where disclosure could be commercially damaging.

Chapter 2

Executive summary

This report starts by establishing the foundation for our evaluation and ends with the evaluation, and conclusions, and recommendations. Chapter 4 covers the theory and practice of investment management. Chapter 5 describes the architecture of ATP. Chapter 6 delves into the construction of the ATP portfolio. Chapter 7 is our evaluation of ATP's investment strategy carried out in the context of theory and practice, the architecture of ATP, and its various portfolios. Chapter 8 summarizes other external views on ATP and presents our reflections on the issues raised. Chapter 9 deals specifically with the communication of ATP's performance. Chapter 10 is our summary of ATP's challenges and our recommendations.

Our approach has been to gather input for our work from as many sources as possible and subsequently to test the conclusion with those who have provided input to our work. The objective was to understand various perspectives to improve the quality of our analysis and conclusions. We are deeply grateful to those who have provided input. However, ultimate responsibility for the analysis, the conclusions, as well as any errors and omissions, remains our own.

The external views we have received cover a wide range of issues, but they cluster around a recognizable set of themes that align closely with our own focus. These include the role of ATP within the broader Danish pension system, the level and form of investment risk, the use of leverage and illiquid assets, the inflation indexation objective, the complexity of the model and its implications for governance and communication, and the appropriate level of contributions.

2.1 Theory and practice of pension fund management

There are two central lessons from our review of the academic literature. First, a pension fund's investment performance must be seen in the context of the characteristics of its liabilities. Second, while financial markets are close to efficient, they are not fully efficient, and a pension fund can use its comparative advantages to generate risk-adjusted returns above passive benchmarks.

The framework for pension fund asset and liability management should be grounded in the economic balance sheet, and the funding ratio is a central measure of financial health. The main pension plan structures are defined benefit (DB), defined contribution (DC), and hybrid designs. The key risks—on both sides of the balance sheet—are longevity, inflation, and interest rate risk on the liability side, and investment risk on the asset side. The optimal investment policy breaks down into a hedging portfolio, which matches the interest rate, inflation, and cash flow characteristics of the liabilities, and a speculative portfolio, which seeks excess returns. What counts as the risk-free asset depends on the nature and horizon of the liabilities. Practical hedging tools include duration matching, cash flow matching, and the use of interest rate and inflation swaps. In a dynamic setting, the allocation between hedging and speculation varies with the funding ratio, the investment opportunity set, and regulatory constraints, which may give rise to procyclical pressures that amplify market stress. Capital requirements, such as those under Solvency II, formalize the solvency buffers needed to withstand adverse shocks while still being able to balance prudential objectives against the risk of procyclical forced selling. Together, these elements provide the analytical foundation for evaluating the investment management and governance of pension funds, including ATP.

Liquid assets—equities and fixed income—are the core building blocks of pension portfolios. Equities provide long-run risk premiums but are volatile. Fixed income is more suitable for hedging pension liabilities. Interest rate and inflation swaps allow pension funds to fine-tune duration and inflation exposures beyond what cash bond markets can provide. By being liquid, having observable market prices, and trading frequently, equities and fixed income can be rebalanced to optimal targets to maintain diversification and control risk while earning return premiums.

Private market investments have become an increasingly important component of institutional portfolios, though their illiquidity, opacity, and cost structure require careful consideration within an asset liability management framework. The growth in allocations to private equity, private debt, real estate, and infrastructure partly reflects a search for higher returns and diversification beyond public markets. The evidence regarding risk-adjusted performance is mixed: while some studies find positive alpha for private equity buyout funds, others find

neutral or negative risk-adjusted returns after properly accounting for leverage, risk exposures, and fees. There is some evidence that more recent returns for private equity have declined as the asset class has matured. Fees on private market investments are at least an order of magnitude larger than fees in public markets. Performance dispersion across managers is large, making manager selection critical, yet the ability to identify and access top-performing managers *ex ante* remains uncertain. For pension funds, private market investments are primarily a return-seeking allocation and belong to the speculative portfolio rather than the hedging portfolio. Moreover, smoothed valuations of private assets may create an artificially stable picture of the funding ratio, potentially understating the true risk on the balance sheet. As a result, pension funds must weigh the potential for higher long-run returns against the governance demands, cost burden, lock-up constraints, and measurement challenges that private market investments entail.

The theory of investment management for the speculative portfolio should presuppose that the liabilities are being hedged. In mean-variance theory, the efficient portfolios—those that obtain the highest return per unit of risk—are constructed by broadly diversifying across risky assets and across multiple sources of return premiums. In the speculative or risk-seeking portfolio, investors should borrow or lend at the risk-free rate according to their risk tolerance and then invest in a mean-variance efficient portfolio that is exposed to compensated sources of risk, including global markets, style factors, illiquid assets, and sources of alpha. The last should be included in a speculative portfolio only to the extent that they are expected to improve the portfolio's risk-return trade-off after accounting for implementation costs, capacity limits, and the residual risk of active bets. When investment opportunities are constant, the speculative portfolio should be rebalanced back to its target weights over time, so that the fund maintains the intended trade-off in terms of long-run risk-return.

Efficient long-run portfolios take advantage of broad, factor-aware diversification and, when appropriate, use leverage to reach target levels of risk rather than over-allocating to equities. Risk-parity investment strategies implement this idea by holding balanced allocations of risk across assets and have historically outperformed standard 60-40 equity-bond benchmarks in normal regimes, though they can be vulnerable when stocks and bonds fall together. While strategic asset allocation is a long-run notion, it requires rebalancing in the short run to maintain diversification by resetting a drifting portfolio to long-run weights. Asset class allocations typically include assumptions for alpha, although we will see that alpha is scarce in liquid markets and often conflated with an illiquidity premium for illiquid assets like private equity and real estate. Governance—benchmarks, tracking-error budgets, and peer framing—can be a significant contributor to returns: poor governance can lead to excessive benchmark hugging or risk-taking on one hand, or over-allocations to expensive strategies yielding poor returns on

the other.

The international and Danish pension industry has changed substantially since the turn of the millennium. One major shift is the rise of funded, asset-backed pension systems, easing the burden on public finances—though many countries, particularly in the EU, still face substantial fiscal challenges from pension obligations. Denmark stands out: large pension savings, high replacement ratios (the ratio of retirement income to working income), and a retirement age indexed to life expectancy. The high Danish pension age supports the combination of relatively low contributions in occupational pensions and a high replacement rate. The coverage of occupational pensions, however, remains a weakness of the Danish system. A second major shift has been the move from defined benefit to defined contribution schemes. In Denmark there has been a gradual disappearance of guaranteed products and growth of market-rate pensions. The product shift has fed through to asset allocation: pension funds, both internationally and in Denmark, have moved away from bonds and toward illiquid or private investments. A final observation is that solvency coverage ratios for Danish funds average around 250 pct, although these figures should be interpreted with some degree of caution, as they are less meaningful for funds without guarantees. Nevertheless, the lowest solvency coverage ratios of around 200 pct are illustrative of the high buffers maintained by most Danish pension funds.

2.2 Architecture of ATP

The purpose of ATP is to pay guaranteed lifelong pensions for almost all Danes. The design of ATP—including ATP's role in the Danish pension system, its product, business model, and investment management—serves that objective. ATP has two objectives. First, the legislation states that the ATP pension is a lifelong, nominally guaranteed pension. Second, the legislation also states that ATP should strive to ensure the real value of pensions. Both objectives have important implications for ATP's investment strategies. The ATP Act is ambiguous with regard to the extent of the inflation indexation. ATP's interpretation leads to a very ambitious investment objective. Legislators should clarify the inflation indexation objective. ATP's evolution has been towards greater complexity, culminating in the introduction of the new business model. The result has been an asset structure that, while still different, has moved in the direction of resembling market-based funds combined with a liability structure that reflects the twin objectives of a nominal guarantee and striving for inflation indexation.

ATP is in Pillar 1 of the Danish pension system, providing the base coverage to almost all Danes as a supplement to Danish state pension, while Pillars 2 and 3 do not cover all Danes. As opposed to the Danish state pension, ATP is funded. Unlike some other forms of public support like housing assistance and heating subsidies, the ATP benefits are not restricted to

particular uses. ATP's assets comprise about 15 pct of all funded pension assets. Pensions in ATP are guaranteed for life, whereas the majority of pensions in Pillars 2 and 3 are not guaranteed and systematic changes in longevity are typically paid for by the individual. The benefits paid by ATP currently make up 7 pct of total benefits paid in Pillars 1–3 and 22 pct of Pillars 1–3 excluding the Danish state pension. The Pillar 1 share of total Pillars 1–3 benefits is expected to drop from around 75 pct today to around 55 pct in 2080 as Pillar 2 schemes mature. ATP matters most for the less wealthy and those in low-income brackets. Around 35 pct of pensioners rely entirely on ATP and public benefits. Ranking members according to the share of their total pension benefits originating from ATP, the top 30 pct have an ATP share of 12 pct.

ATP is based on a collective pension fund model, where all members share investment, longevity, and insurance risk. The primary collective funds are placed in a collective pool, the Bonus Potential. The Bonus Potential is the “capital buffer” of ATP and subsumes all risk-sharing across the collective. The “Collective Buffer,” of which the Bonus Potential is by far the largest part, is the difference between the value of the assets and the value of the pension rights to the members. The funds that are not part of the Collective Buffer belong to the members in the form of individual pension rights. The pension rights constitute the calculated annual pension payment that the member has a right to receive in the future. In ATP these are mostly guaranteed. Members are in ATP for life and cannot surrender their policies. Hence, members do not have an individual deposit. In contrast to ATP, the typical funds in Pillars 2 and 3 divide the collective into different subgroups (contribution groups). The funds typically have surrender risk and operate with individual deposits. There are redistribution risks in both business models, but they can be addressed. The appointed actuary has a responsibility to ensure that the pension basis, including the bonus scheme, is fair. Fairness in ATP differs in some ways from that of the rest of the sector, primarily because the guaranteed annual payments from contributions in a specific year are the same for all members.

The ATP product has changed over time, and each change has brought about an increase in complexity of how the investments are managed. The most recent changes are the introduction of the Supplementary Hedge Portfolio in 2023, the introduction of the Market Return Portfolio in 2022, and the change to 15-year interest rate hedging in 2015. The timing in implementing the change has sometimes, in retrospect, been poor, as it has resulted in losses. As a result of the changes, the ATP pension has become increasingly similar to market-based products on the asset side, while maintaining ultimate guaranteed obligations.

Inflation indexation

Bonuses serve the purpose of providing write-ups to pension rights with the aim of ensuring an ambitious inflation indexation. Bonuses redistribute means from the collective to the individ-

ual and are irreversible. When a bonus is paid out, the collective buffer shrinks, and with it so does ATP's risk capacity. The bonus ratio, which is the Bonus Potential relative to the value of the pension rights, is around 20 pct at ATP. The higher the bonus ratio, the higher the pension fund's solvency, and, all other things being equal, the greater ATP's capacity to take risk and to pay a bonus. Since 2002, the ATP Act states that ATP "should strive towards a long-term bonus policy that preserves the real value of pensions." Pension rights are based mainly on a nominal interest rate guarantee, which includes compensation for expected (or average) inflation and a real rate. Writing up the pension rights with realized inflation means compensating for inflation twice—once for expected inflation in the nominal guarantee and another time for realized inflation as pension payments are indexed. It is not possible to devise an investment strategy that delivers twice the inflation and the real rate in all scenarios. When the bonus ratio is around 20 pct, the return on the Bonus Potential needs to be large to deliver a write-up of pension liabilities with inflation. This constitutes a major challenge and raises questions regarding whether the inflation ambition is too high compared to the risk ATP should run in its portfolios. Under the current business model and risk target, ATP expects to write-up pension rights with realized inflation with a probability of around 60 pct assuming a long-run rate of inflation of 2 pct starting on a funding ratio of 120 pct.

Pensions and contributions

A 66-year-old person who has contributed to ATP throughout their entire working career can expect to receive a lifelong pension that amounts to DKK 25,400 per year. The expected pension payments for other member age groups depend primarily on the level of interest from the time contributions were paid and the allocated bonus.

Each member's contribution is split into the following main components:

- *80 pct into individual pensions rights, which apply for the entire lifetime—that is, life-annuities.* This contribution is further split depending on the number of years to retirement:
 - Until 15 years before retirement:
 - * 60 pct into a rolling 15-year interest rate guarantee ("rolling annuity").
 - * 20 pct into a market risk product ("variable annuity").
 - Less than 15 years to retirement:
 - * 80 pct into a lifelong guarantee ("whole-of-life annuity").
 - At 15 years before retirement all monies allocated to individual pensions rights will

gradually be converted into a lifelong guarantee. At retirement, all pension rights become a lifelong guarantee.

- *20 pct into the collective Bonus Potential, which has full risk capacity and carries no pension rights.*

During the whole lifetime of the member, the Bonus Potential will provide write-ups to pension rights, and it will cover longevity risk.

The portion of the pension rights, which are guaranteed, comprises the backbone of ATP's current pension liabilities. The sum of those pension rights across all members, corrected for expected mortality, gives rise to an expected liability cash flow. If expected mortality or other actuarial assumptions change, the shape and size of the cash flow will change. For every contribution made, or bonus paid, the shape and size of the cash flow will also change. The present value of the cash flow is called the Guaranteed Benefits. The Guaranteed Benefits are marked-to-market daily using a risk-free discounting curve of interest rates. The current discount curve contains two main elements:

1. A term structure of risk-free interest rates up to 30 years maturity.
2. An extrapolation mechanism from 30 years and outwards.

Balance sheet items

ATP's architecture can be understood as a set of liability elements, each of which has a representative portfolio on the asset side, that serves the purpose of covering the corresponding liability item. ATP's obligations to members are recorded as liabilities on its balance sheet. Assets are held in portfolios that cover specific liabilities.

There are five major liability items on ATP's balance sheet, the sum of whose market values are equal to the assets under management (AuM):

1. Bonus Potential (BP)—the ultimate risk-absorbing collective buffer.
2. Guaranteed Benefits (spread-adjusted).
3. The reserve for the Life Annuity with Market Exposure (H_m).
4. Long-term Supplementary Reserve (LSH)—the loss-absorbing part of the guarantees.
5. Risk adjustment—provision for uncertainty regarding non-financial risk.

The first four liabilities have a “risk covering” asset portfolio where the profit and loss fluctuations of the liability item are matched by the change in value of the asset portfolio, to greater

or lesser degrees. There are four main asset portfolios:

1. Investment Portfolio (INV).
2. Market Return Portfolio (M).
3. Supplementary Hedge Portfolio (SAP).
4. Interest Rate Hedge Portfolio (AFD).

The market values of the four asset portfolios do not exactly equal the market value of their corresponding liability item. The first three portfolios are the “Risk-seeking Portfolios” that serve the purpose of growing pensions more than what is promised in the pension rights. Any profit and loss mismatch between a covering portfolio and its liability item, whether stemming from market, insurance, or operational risk, ultimately lands in the Bonus Potential. Hence, the Investment Portfolio is the ultimate residual portfolio on the asset side. There is a fifth portfolio, the Treasury Portfolio, whose purpose is not to cover market risk of a liability item, but rather to utilize excess liquidity in ATP's balance sheet to fund leveraged positions in the four covering portfolios and manage liquidity risk in these. The Treasury Portfolio enables the use of leverage in the Risk-seeking Portfolios. There is also a tax asset on the balance sheet. The tax asset arises from losses in investment returns, primarily in 2022. This government receivable yields zero interest and causes a running funding cost on ATP's investments.

The members in ATP do not have an option to surrender their policies and hence the guaranteed cash flow is highly illiquid, which creates additional risk capacity. To account for this, an illiquidity spread is added to the discounting curve. The difference between the discounted value of the Guaranteed Benefits with and without the illiquidity spread is called the Long-term Supplementary Reserve (LSH). The Long-term Supplementary Reserve signifies that the guarantees have a loss-absorbing capacity, but only in the short term, consistent with the fact that ATP must deliver the obligated cash flows at retirement. The Long-term Supplementary Reserve introduces additional risk capacity in the Guaranteed Benefits enabling ATP to take on more investment risk. Hence, there is a dedicated portfolio, the Supplementary Hedge Portfolio (SAP), matching the Long-term Supplementary Reserve. The value of the Long-term Supplementary Reserve changes daily due to:

1. Changes in the discount rate.
2. Profit and loss from the Supplementary Hedge Portfolio.

The profit and loss accumulate a surplus or deficit over time. If the accumulated surplus exceeds an upper threshold, funds are transferred to the Bonus Potential. If an accumulated

deficit falls below a lower threshold, funds are transferred from the Bonus Potential to the Long-term Supplementary Reserve. Hence, the Bonus Potential is the ultimate risk-absorbing buffer.

2.3 Construction of the ATP portfolio

ATP's portfolio construction is organized around the interaction between its guaranteed pension promise and its capacity to bear investment risk. The Guaranteed Benefits are hedged through the Interest Rate Hedge Portfolio, in conjunction with the Treasury Portfolio, which also supports leverage implementation. Risk-seeking exposures are defined through a factor-based investment framework. Required returns and risk appetite determine how much risk is taken. The Investment Portfolio (INV), Market Return Portfolio (M), and Supplementary Hedge Portfolio (SAP) implement that risk through liquid and illiquid pooled funds, employ leverage, and make use of derivatives and internal funding.

ATP's investment beliefs

ATP's investment philosophy rests on explicit beliefs about financial markets, about ATP as a liability-driven investor with a long horizon and a Bonus Potential to protect, and about ATP's role in Danish society. These beliefs together imply that risk is the first-order decision, that diversification is applied at both high and detailed levels, that strategic allocation matters more than tactical, that currency risk is hedged by default, and that ESG is pursued not as an end to itself but as a part of the investment process.

ATP's Interest Rate Hedge Portfolio and Treasury Portfolio are the foundations of its balance sheet construction. The Interest rate Hedge Portfolio is designed to meet the guaranteed pension promises by immunizing the interest rate risk in the Guaranteed Benefits, while the Treasury Portfolio manages the liquidity, collateral, and internal funding that allow the rest of the portfolio to operate.

ATP's factor framework defines the rewarded returns that the Risk-seeking Portfolios are designed to harvest. Rather than first allocating to asset classes, ATP organizes exposures around four broad factors: Equity, Rates, Inflation, and Other. This structure allows ATP to compare risks across liquid and illiquid assets, combine exposures that have similar economic drivers, and build more diversified Risk-seeking Portfolios than a conventional equity-bond allocation. This framework is supported by long historical backtests and factor performance across macro regimes. However, the factor portfolios are very different from traditional market-cap-weighted benchmarks and 60-40 equity-bond portfolios, which can lead and have led to persistent deviations from these reference portfolios.

Required returns and risk appetite

ATP's required return on the funds in the Bonus Potential to deliver an indexation of the Guaranteed Benefits of 2 pct is high relative to most institutional portfolios, around 17 pct per year, equivalent to an annualized volatility target of 30 pct in the Investment Portfolio, taking into account a risk allocation to the Supplementary Hedge Portfolio. This is because the ambition to preserve the real value of guaranteed pensions must be funded out of a Bonus Potential that is much smaller than the Guaranteed Benefits.

Because risk on the Investment Portfolio is scaled as a percentage of the Bonus Potential, ATP's dynamic risk profile acts similar to a Constant Proportion Portfolio Insurance (CPPI) strategy. When the balance on the Bonus Potential increases, the Investment Portfolio can take more absolute risk; when the Bonus Potential falls in value, risk is reduced to protect the guarantee floor. ATP's implementation, however, is not a pure CPPI strategy. ATP maintains a minimum absolute level of risk when the Bonus Potential is low. The resulting risk profile has a "hockey stick" shape: risk declines as the funding ratio falls, but it does not fall all the way to zero when the funding ratio is near one. This makes ATP's strategy a hybrid between CPPI and constant-mix investing, preserving some return-seeking capacity even when the balance sheet is under pressure.

ATP sets its risk appetite through the balance sheet items that absorb gains and losses, and it differs from a conventional strategic asset allocation, which is based on fixed equity-bond benchmarks. The Supervisory Board defines the aggregate risk tolerance in terms of Expected Shortfall, ES(99 pct, 3M), which is the average loss in the worst 1 pct of outcomes over a three-month horizon. The risk is set in terms of the Bonus Potential, the buffer that absorbs investment losses, with the maximum aggregate tolerance of 50 pct of the Bonus Potential after tax. The risk targets for the Investment Portfolio (INV), the Market Return Portfolio (M), and the Supplementary Hedge Portfolio (SAP) are then tied to the specific balance sheet items that bear the returns from each portfolio.

Measured against AuM, ATP's risk is comparable to a low- to medium-risk pension product; measured against the Investment Portfolio, ATP operates at a very high level of risk. The Investment Portfolio's 30 pct volatility sits at the upper end of the institutional investor distribution and is in the territory of the highest-volatility individual hedge funds. At the Supervisory Board's maximum tolerance, ATP's risk limit is roughly equivalent to a Solvency II coverage ratio of 103 pct. In normal conditions, actual risk consumption is typically around 70 pct of the Supervisory Board limit, corresponding roughly to a Solvency II coverage ratio of 150 pct. This reflects the trade-off between preserving solvency and generating a sufficiently high return to support future bonus allocations.

ATP uses leverage to convert limited risk-bearing capital into the investment exposures needed to meet its required return. The leverage arises from three sources. First, the Interest Rate Hedge Portfolio's use of interest rate swaps in place of some physical bonds, which deliver duration without consuming cash. Second, the need to scale the Risk-seeking Portfolios' exposures above the cash capital sitting in the Bonus Potential. Third, the diversified factor portfolio's lower volatility per unit of notional exposure, which requires additional leverage to reach the risk target compared to an all-equity or traditional 60-40 equity-bond reference portfolios.

Leverage is implemented with derivatives, with collateral management, margin operations, and internal funding from the Treasury Portfolio keeping, liquidity and balance sheet risks under control. With approximately three-quarters of liquid market exposure held synthetically at the end of 2025, gross leverage is approximately $2.4\times$ AuM and net leverage is approximately $2.0\times$. Using the Investment Portfolio as the denominator, net leverage is approximately $5.3\times$.

Investment implementation

ATP turns its factor framework and risk mandates into concrete portfolio positions through two design choices. First, the three Risk-seeking Portfolios—the Investment Portfolio (INV), the Market Return Portfolio (M), and the Supplementary Hedge Portfolio (SAP)—invest through shared liquid and illiquid pooled funds rather than through separate portfolios; this gives each portfolio access to the same factor-balanced exposures while maintaining its own risk mandate at the balance sheet level. Second, risk is allocated across factors through a hierarchical risk-budget process that runs from individual instruments to subfactors to factors to the overall portfolio, with risk (not capital) as the unit of allocation.

ATP has drawn some important lessons from its portfolio of illiquid investments especially with direct investments. In several cases it has proven more difficult than expected to manage these ownerships, and for ATP to create value as an investor. In addition, investments were too concentrated for a number of years and in overly large individual investments, which has made ATP vulnerable to the common risks associated with being a co-owner of a specific company. These experiences provided an opportunity to set strategic focal points for the approach to ownership of illiquid investments moving forward. The purpose of the strategic focal points is to guide ATP's future work within illiquid investments. Even if ATP follows these guidelines moving forward, legacy positions will continue to make up a substantial share of the illiquid portfolio over the next several years, and the new strategic direction will only gradually become the dominant influence on portfolio composition. However, since 2020, ATP has been successful in gradually scaling down the illiquid portfolio in accordance with the investment strategy. This strengthens the outlook for turning ATP's illiquid portfolio in the direction set by ATP's strategic focal points.

ATP's investment governance framework assigns strategic risk choices to the Supervisory Board and implementation choices to the daily management. The Supervisory Board sets the risk appetite, portfolio risk targets, factor targets, and limits within which the investment organization operates; the daily management then implements those decisions through the liquid and illiquid pools, investment processes, and daily risk controls.

2.4 Evaluation of investment strategy

The delivery of lifelong pensions is the primary criterion on which ATP is evaluated. The investment performance is a means to that end. The assets under management (AuM) move with interest rates and liability valuations in ways that do not purely reflect investment success or failure. Nevertheless, we compare ATP's overall balance sheet and sub-portfolio performance against several common reference portfolios: global equities, global fixed income, 60-40 equity-fixed income portfolios, and levered 60-40.

ATP's investment beliefs are coherent, its investment implementation is consistent with those beliefs, and they broadly reflect economic theory and empirical evidence—with an exception for illiquid markets. While ATP's investment philosophy is internally consistent, it leads to a portfolio that is different, complex, potentially difficult to benchmark, and can result in performance very different from peers. Although peer risk should not drive the portfolio, it is a real risk that should be managed through clear communication and governance.

Market backdrop

ATP's investment performance can only be understood in the context of a market environment in which there have been significant developments. The level of long-term interest rates is the most important market variable for understanding the evolution of ATP's guaranteed liabilities. The long period of falling yields abruptly ended in 2022. Global equity markets delivered strong overall long-run returns over the evaluation period, but there has been substantial regional variation and periodically severe drawdowns. It is important to consider the co-movements of equities and bonds because both are major components of the Risk-seeking Portfolios and because the diversification between them is a key determinant of overall portfolio performance. During much of the period from the late 1990s through 2021, stock-bond correlations were often negative or only modestly positive, which made bonds an effective diversifier in multi-asset portfolios. 2022 stands out as a historic outlier in the joint distribution of equity and bond returns—indeed, it was the worst year for US bonds in a century of standard return data (and among the worst in return series extending back to the late 18th century), and one of the rare years in which large losses on both asset classes occurred simultaneously.

The large volatility, both on the upside and downside, of market returns of 2020–2023 is an informative stress test. Throughout this period, ATP's balance sheet remained robust, the hedge value and funding ratio were maintained, and the treasury and liquidity setup avoided forced deleveraging. At the same time, there were large increases in the risk and capital share of illiquid assets, which posed some constraints on rebalancing.

Pension sustainability

ATP's asset and liability model (ALM) indicates that the pension promise is sustainable at the current risk level but the level of risk is high. The sustainability is conditional on the model assumptions that ATP can de-risk if conditions deteriorate, that it can maintain a minimum level of risk when there are large losses on the Bonus Potential (BP), and that it can stay the course through prolonged drawdowns. The Supervisory Board has accepted a small, but non-zero, probability of 0.6 pct over a 10-year horizon of technical insolvency (a negative BP) to support bonus capacity, the indexation ambition, and to meet other claims on the BP such as increased longevity risks. This probability is calculated allowing for management actions as opposed to Solvency II calculations, which generates a somewhat higher probability of insolvency, and points to a high risk level. ATP has maintained a stable bonus ratio, which is a significant achievement given market dynamics, but realized bonuses have not kept pace with inflation. In ATP's ALM simulations, inflation indexation is achieved in 59 pct of scenarios over a 10-year horizon for long-run inflation averaging 2 pct and 20 pct of cases when long-run inflation averages 4 pct.

Balance sheet dynamics

The headline return on ATP's total wealth of 5.6 pct per year over 2002 to 2025 is equal to the return achieved by a 60-40 equity-bond portfolio over the same horizon. The Risk-seeking Portfolios on their own have a Sharpe ratio of 0.75, slightly above the Sharpe ratio of a 60-40 portfolio of 0.68. The combined Interest Rate Hedge and Treasury Portfolio, which is the majority of ATP's balance sheet, has delivered a negative return over 2002 to 2025, especially in 2022. 2022 also saw a decrease in the Guaranteed Benefits because interest rates increased.

ATP's risk-taking has moved through four regimes since 2009, but total balance sheet risk has been broadly stable at around 12 pct annualized volatility on AuM since 2014. Investment risk was very high before 2011, low from 2011 to 2018, moderate from 2018 to 2023, and high again under the new business model from 2023 onwards. The low risk taken from 2011 to 2018 reduced returns because it coincided with a period of strong performance in risky assets, so ATP participated less in the market rebound after the Global Financial Crisis (2008–2009) than it would have if it had held risk constant at the post-2018 risk level. Total asset risk has been

stable because the Interest Rate Hedge Portfolio remains the dominant balance sheet risk item, even as investment risk on AuM has increased from approximately 3 pct to approximately 7.5 pct over the evaluation period.

Leverage rose to its highest level by 2025 under the new business model, but unencumbered cash has remained above 10 pct of the balance sheet throughout the evaluation period. This indicates that the increase in leverage has been accompanied by adequate liquidity. Leverage rose from 2017 to 2021, fell sharply in 2022 with the rate shock, and rose to its highest levels in 2025. This pattern reflects ATP's risk-budgeting framework: a larger Bonus Potential provides greater capacity to absorb losses and therefore permits larger investment exposures, which mechanically increases leverage when the Bonus Potential is high. This also highlights that ATP has right-way-risk with respect to liquidity, as ATP can choose to lower risk to preserve liquidity buffers.

Over 2015–2025, ATP's Interest Rate Hedge Portfolio performed as designed, closely tracking the guaranteed liabilities it hedges, while its Risk-seeking Portfolios delivered positive returns but underperformed a conventional 60-40 equity-bond portfolio on a risk-adjusted basis; its illiquid portfolio earned a modest illiquidity premium over the same reference. The shortfall in liquid assets reflects ATP's deliberate factor construction—lower exposure to equities, which performed strongly over the period, and more exposure to fixed income, which performed poorly, especially in 2022—rather than weak implementation within asset classes, where ATP has generally tracked or modestly outperformed its reference indices. Foreign equities, which have delivered returns materially below a broad equity reference, is the biggest exception.

Investment performance

We evaluate ATP's investment performance against three simple reference portfolios (global equities, global fixed income, and a 60-40 mix) and against asset class-specific reference indices guided by simplicity but mindful of the limitations that return comparisons entail. These reference portfolios are passive, investable alternatives rather than governance hurdles, and all comparisons are ex post. To compare investments that combine cash assets and derivatives on a common basis, we scale returns to a constant ex-ante volatility, and we use metrics like alpha, beta, and appraisal ratio to assess whether deviations from the simple reference portfolios were rewarded.

ATP's Interest Rate Hedge Portfolio has performed as designed, closely tracking the value of the guaranteed liabilities it hedges. Its losses, including the large losses of 2022, are the counterpart to offsetting reductions in the market value of those liabilities rather than evidence of a failed hedge—a close tracking that is an achievement given the absence of truly long-dated

assets.

ATP's four-factor portfolio (Equity, Rates, Inflation, and Other) earned positive returns over 2017–2025, but performance was uneven across factors and trailed a 60-40 portfolio on both return and risk-adjusted metrics, with the shortfall most pronounced over 2020–2025. The Equity factor was the strongest contributor, the Inflation factor proved a valuable diversifier through the post-2020 inflation shock, and the Rates and Other factors disappointed; ATP's deliberate underweight to the Other factor added value given its weak realized performance.

ATP's total liquid portfolio materially underperformed the 60-40 portfolio over 2015–2025, with a Sharpe ratio of 0.41 against 0.68, driven by its smaller exposure to equities and larger exposure to fixed income during a period of strong equity and weak bond returns. Within asset classes, however, ATP's implementation was broadly in line with, or ahead of, market-capitalization-weighted references for most asset classes, with the notable exceptions of foreign equities, inflation-related assets, and to a lesser extent global fixed income. After controlling for reference-market exposure, active implementation was generally positively compensated outside those three asset classes.

For illiquid assets, where evaluation is less straightforward and smoothed valuations complicate short-term comparisons, ATP's investments modestly outperformed their liquid references, with a weighted-average public market equivalent of 1.07 and a small, annualized illiquidity premium over the 60-40 portfolio of less than 1.0 pct. Private equity and Infrastructure outperformed their public-market equivalents. Private credit and Real estate outperformed their asset-specific references; ATP's largest direct investments—four deals each exceeding DKK 2 billion in commitments—detracted from overall performance, yet the total portfolio of illiquid investments (including those unsuccessful large deals) modestly outperformed a 60-40 reference.

Leverage

ATP should continue to use leverage while strengthening the conditions under which it is reported, governed, and explained. Given the current ATP product, removing leverage would require accepting a much lower expected return, a lower indexation ambition, concentrating risk in a less diversified portfolio, or a combination of all three. That may be a legitimate product design choice, but it is outside our mandate and is not a feasible choice to meet pension promises within the existing design. ATP should report gross leverage, net leverage, and unencumbered cash routinely alongside its Expected Shortfall measures, consistent with the [IOSCO \(2019\)](#) emphasis on using multiple leverage measures. ATP should also disclose risk measures which involve collateral calls the Investment Portfolio is designed to withstand under histori-

cal and forward-looking stress scenarios. Finally, ATP should communicate leverage in terms of both total balance sheet and Bonus Potential terms, making clear how much leverage comes from hedging, how much from Risk-seeking Portfolios, and how much from implementation choices. These recommendations are not a change in investment strategy; they are conditions for maintaining confidence in a strategy that we view as well-founded but necessarily complex.

Danish equities

ATP maintains a deliberate home bias in Danish equities and its performance has been very strong. ATP holds DKK 36 billion in Danish equities, 5.2 pct of AuM and 9.6 pct of the risk in the Risk-seeking Portfolios, far above Denmark's 0.42 pct weight in the global market, though only modestly above the 4.3 pct held by Danish pension fund peers. The portfolio returned 12.2 pct per year from 2015 to 2025, with positive alphas over both Danish and global market indices. This reflects two active decisions: the overweight to Denmark itself relative to other global markets, and security selection within the Danish market, where ATP plausibly holds a comparative advantage through its knowledge of and engagement with Danish companies. The home bias has declined over time as ATP has reduced its risk exposure in Danish equities. The investment approach is distinctive within ATP—fundamental, bottom-up, and relationship-driven, with active stewardship, in contrast to the quantitative, top-down methods used elsewhere in the portfolio. ATP's role in the Danish market is also widely seen as constructive. The commercial and market-level benefits are part of ATP's rationale, but the central question is whether the financial case carries the size of the position.

We evaluate the home bias along six dimensions, and there is a real, but conditional, case for overweighting Danish equities. For a home bias position, the case is not as unfavorable as it could be because realized risk-adjusted returns have been very high, the allocation has diversified total portfolio risk and provides some balanced sector exposure, and direct exposure to the Danish economy is limited because the portfolio companies are heavily globalized. However, none of these is sufficient on their own to justify the overweight position going forward. The position concentrates a specific Danish country risk—an isolated 30 pct shock to Danish equities currently reduces the bonus ratio by about 1.3 percentage points—and the small, semi-liquid Danish market is harder to exit in a downturn, both financially and politically, as 2022 showed; at that low, Danish equities made up roughly half of liquid equity exposure. A home bias is common among institutional investors and can be justified by superior local knowledge, but its mere prevalence is not an argument for an outsized position. Without continued risk-adjusted outperformance, the extent of ATP's overweight is difficult to justify on financial grounds alone.

Illiquid assets

ATP has a sound rationale for investing in illiquid assets. It is a long-term investor with non-surrenderable liabilities, ample and low-cost funding, and large size. Illiquid assets may also broaden the opportunity set and provide some diversification. However, ATP's leveraged, dynamically rebalanced investment model means that the key constraint is not ordinary liquidity risk, but rebalancing risk: the risk that ATP cannot adjust risk exposures in illiquid assets in the short term when the funding ratio changes. ATP's illiquid allocation peaked at 25 pct of AuM (DKK 170 billion) in 2022 and has been brought down to approximately 17 pct (DKK 120 billion) by the end of 2025. Compared to Danish guaranteed pension funds, this is not a high allocation to illiquid assets, but ATP's inflation-indexation ambition on top of nominal guarantees and leveraged Risk-seeking Portfolios create a greater need to rebalance risk dynamically than is typical for other guaranteed pension funds. Following the pattern of capital allocation to illiquid assets, the share of illiquid asset total risk rose sharply in 2022, reaching nearly 70 pct. This was very high because liquid risk was reduced while illiquid exposures could not be adjusted quickly. Starting around 2020, ATP has reduced the illiquid risk share to a historical low of about 26 pct, partly through active management of illiquid exposures and partly through the phase-in of the Supplementary Hedge Portfolio (SAP), which absorbs a large share of the illiquid risk previously residing in the Investment Portfolio. This effectively allows the risk of illiquid assets to be moved from one part of ATP's portfolio to another part that is designed for more long-term, illiquid assets.

ATP's lessons learned in illiquid markets are sensible and well-grounded in the academic literature: direct ownership is demanding, vintage and size concentration matter, choice of co-shareholders and governance structures is important, thematic investments can lead to poor entry points, and concentration discipline is essential. ATP's capacity to bear illiquidity—its long horizon, sticky liabilities, scale, and lack of surrender risk—supports continued investment in illiquid assets, but capacity is not the same as a comparative advantage in earning excess returns. ATP's framework is very strong on the risk side, yet it would benefit from further developing a returns or alpha framework that articulates how, and where, ATP expects to generate excess returns in illiquid markets given its constraints. ATP Real Estate and Private Equity Partners offer useful models of what has worked.

ATP's current strategic focus on reducing concentration, improving governance, and strengthening its approach to direct investments is appropriate. A stronger framework for determining the optimal illiquidity share would help clarify the trade-off between potential illiquidity premiums and the rebalancing constraints created by ATP's business model.

Currency hedging

ATP hedges close to 100 pct of its non-euro foreign-currency exposure to Danish kroner. This policy follows from its belief that currency risk is, on average, uncompensated, so that the fully hedged position is the neutral one. This is somewhat above ATP's Danish peers and high by international standards, where hedging is partial and varies with asset class, home currency, and liabilities.

Full hedging is nonetheless well-founded for ATP. In a mean-variance framework the optimal hedge is high for fixed income and lower for equities, especially for safe-haven currencies such as the dollar, but for ATP's fixed-income-heavy, balanced-beta portfolio, a hedge ratio near 100 pct is appropriate. Where ATP does want currency exposure, it is better taken as a deliberate, dynamically sized position, as in the Other factor, than as a standing deviation from full hedging, because currency risk premiums vary over time.

The costs of hedging are small. The largest explicit cost, the cross-currency basis on the dollar, is much reduced by taking exposure through derivatives, though partly swapped for a financing spread embedded in derivative prices; the cost that binds hardest at ATP's scale is the liquidity and margin demand that a large hedge creates in stress. Either way, how ATP implements its hedges matters as much as the ratio it targets.

Performance over 2020 to 2023

Overall, the period 2020–2023 serves as an informative stress test. Returns were weak, especially in 2022, but ATP's balance sheet remained robust, the hedge portfolio continued to match the liabilities and the funding ratio was maintained, and the treasury and liquidity setup avoided forced deleveraging. At the same time, there were large increases in the risk and capital share of illiquid assets that did pose some constraints on rebalancing.

New business model

ATP's new business model introduced two main changes. First, ATP introduced the Life Annuity with Market Exposure, which resembles a market-rate product in that the value of the pension entitlement varies with the return on the Market Return Portfolio. Second, ATP introduced an amended hedging framework that takes account of the illiquid nature of ATP's liabilities. Under this framework, the Long-term Supplementary Reserve (LSH) acts as a buffer for the associated asset portfolio, the Supplementary Hedge Portfolio (SAP). When the Supplementary Hedge Portfolio performs sufficiently well, funds are transferred from the Long-term Supplementary Reserve to the Bonus Potential to support higher bonuses. Conversely, when the Supplementary Hedge Portfolio performs sufficiently poorly, funds are transferred from

the Bonus Potential to the Long-term Supplementary Reserve.

The new business model can raise expected pensions and stabilize ATP's risk-taking, but it does so by accepting a deliberate increase in the risk that ATP cannot honor its guarantees.

The new model can deliver the same likelihood of 2 pct inflation indexation at a lower required return on the Investment Portfolio. ATP has chosen not to take this benefit as lower risk; instead, it keeps investment risk unchanged and uses the model to increase the likelihood of meeting the indexation target. The new model can also deliver a more stable risk level across market conditions. As the funding ratio falls toward 100 pct, the equity-equivalent allocation declines by about 40 pct under the new model, against about 60 pct under the old one. These benefits come at a cost: the model roughly doubles the 10-year probability of technical insolvency, from 0.3 pct to 0.6 pct. The level remains low, but the figures reflect relative rather than absolute risk (they allow for management action and exclude the harsher Solvency II scenarios). The increase represents a deliberate break with ATP's guarantee-based model, and the guarantee is ATP's central contribution to a Danish pension system that is otherwise moving toward market-based products.

The construction rests on one presumption: that ATP's Supervisory Board can stay the course.

The Supplementary Hedge Portfolio only works if losses are allowed to accumulate rather than being realized early. Should the Supervisory Board realize losses prematurely—or be replaced by one that does—the mechanism fails. Management has a standing obligation to keep the Supervisory Board aware of the risks and requirements of this design.

Peer comparisons

ATP's characteristics—defined by its role in the Danish pension system, its pension product, and its investment strategy—are distinctive, making peer comparisons difficult. ATP thus has no natural peers either domestically or abroad and peer comparison is therefore a non-trivial task. Nevertheless, journalists, experts in pensions or investments, or academics occasionally make different kinds of comparisons between ATP and other institutional investors (such as the Norwegian Government Pension Fund Global or Danish pension funds). The criteria for selecting the peer group are often related to being “large,” “public,” or “Danish.” When the criteria for selecting the peer group are unclear, the comparisons will most likely lead to misleading conclusions.

However, ATP's uniqueness does not imply that ATP should never be benchmarked to other investors. The most relevant peers for ATP depend on the comparison being made and would include investors with similarities on either the liability side (such as pension funds) or on the asset side (such as risk parity investors). Regardless, comparisons (investment performance,

solvency, or other dimensions) should be made with caution, taking the underlying differences into account. Compared with Danish pension funds over the last decade, ATP's return on the Investment Portfolio has been high. However, on a risk-adjusted basis, the return has been relatively low. ATP's long run wealth accumulation ranks around top third when compared to the Danish life insurers and occupational pension funds, but on a shorter horizon ATP ranks at the bottom. ATP's returns are higher than some international risk parity investors.

Costs

ATP is a statutory pension scheme, which means that the members cannot decide to leave, and therefore it is crucial for ATP to be cost-effective to ensure responsible management of the funds. The total cost of operating ATP Lifelong Pension in 2025 was 0.31 pct of AuM. ATP's cost ratio has decreased over the last ten years.

ATP's cost level is among the lowest in the pension fund industry—both domestically and internationally. Within Scandinavia, ATP's cost level is on par with the Swedish AP Funds but naturally higher than Norway's Government Pension Fund Global (GPFG), which has no individual members. ATP's administration costs for 2025 were DKK 36 per member—significantly lower than the international peer average of nearly DKK 700 per member. ATP's investment costs are among the lowest across both Danish and global comparisons. A large share of ATP's total costs arises from the illiquid portfolio and performance fees from investing in private equity funds. Notably, the years with large performance fees reflect strong returns in ATP's private equity portfolio.

2.5 Communication

ATP faces a challenge in communicating its performance, as public focus falls either on the return on the Investment Portfolio or the return on all its assets under management. The return on the Investment Portfolio is volatile, as it is designed to take high risk. The total return reflects that more than half of the assets are set aside to hedge the liabilities. The liabilities are long-term liabilities, the value of which is driven primarily by long-term interest rates. Neither of the two perspectives conveys the right story on ATP's overall performance.

It is not an easy task to communicate something as complicated as delivery on a pension promise. While there is consensus on the approach, optimal communication is still seldom achieved, if ever. Most report on investment metrics. This is the case for both international funds and Danish funds.

ATP's primary performance indicator should be how well it delivers pension payments within

the context of its obligations and as part of the overall Danish pension system. The two key metrics should be the pension it delivers and the risk related to that delivery. These are the metrics that will be the focus of most of its members, including the more sophisticated.

The financially interested, including professionals, will want to understand how ATP delivers the pensions. Therefore, the performance of sub-portfolios and tactical overlays should be communicated, but as second-order decisions and measured against the role of the sub-portfolios and relevant benchmarks. The results of the different portfolios should ultimately be shown to match the income statement and the new balance sheet.

There should be continuity and consistency between what is communicated and how the internal machine is set up. ATP must not succumb to the temptation to overcommunicate returns on the Interest Rate Hedge Portfolio when interest rates decline, nor should it overcommunicate returns on the Investment Portfolio when these are merely the result of the risk level. ATP should continuously make clear that its investment strategy will deliver a volatile bottom line but that this is the price for ATP's ability in the long run to deliver the best possible pension according to its remit at the lowest possible risk.

Together with ATP staff, we have made progress on communication, but work remains to be done. ATP should continue its work in this area and preferably with the input from external partners that can help build credibility for the approach.

Part II

Evaluation of ATP's investment strategy

Chapter 3

Introduction

Key message

This report starts by establishing the foundation for our evaluation and ends with the evaluation, and conclusions and recommendations. The remainder of this report consists of ten chapters. Chapter 4 covers the theory and practice of investment management. Chapter 5 describes the architecture of ATP. Chapter 6 delves into the construction of the ATP portfolio. Chapter 7 is our evaluation of ATP's investment strategy. Chapter 8 summarizes external views on ATP and presents our views on the issues raised. Chapter 9 deals specifically with the communication of ATP's performance. Chapter 10 is our summary of ATP's challenges and our recommendations.

Our approach has been to gather input to our work from as many sources as possible and subsequently to test the conclusion with those who have provided input to our work. The objective was to understand various perspectives to improve the quality of our analysis and conclusions. We are deeply grateful to those who have provided input. However, we are ultimately responsible for the analysis, the conclusions, as well as any errors and omissions, remains our own.

There are two central lessons from our review of the academic literature. First, a pension fund's investment performance must be seen in the context of the characteristics of its liabilities. Second, while financial markets are close to efficient, they are not fully efficient, and a pension fund should use its comparative advantages.

The objective of this section is to create clarity about our approach. We outline the structure of the report in Section 3.1. We summarize whom we have consulted and why in Section 3.2, and we reflect on our mandate in Section 3.3. We list the deep dives that we have carried out in Section 3.4, and the approach we have taken in relation to the literature, including the use of

other performance reviews, in Section 3.5.

3.1 Structure of the report

We have endeavored to make the report readable for a broader audience, including through use of introductory paragraphs in each section, but ATP is a complex set-up. The report and its various sections can be read in full or browsed by reading the introductory paragraphs in each section or the introduction sentence in each paragraph. We have a communication obligation in delivering our analysis that goes beyond ATP's Supervisory Board and experts. ATP is an important part of Danish society and as such has been the subject of public debate. Our report should also fulfill a role in underpinning these discussions. To do justice to the topic, our report is lengthy and at times deals with complex topics. ATP is a complex set-up, and its performance deserves regular external assessments that can serve as both input to the Supervisory Board and a basis for public discussion of an important element of the Danish pension system. The report reflects our unanimous view as evaluators reached through extensive discussion. We hope it will also be valuable to others.

3.2 Meetings

We have held meetings with people from outside ATP, with ATP staff, and with ATP's Supervisory Board. We have held meetings with 22 people from outside ATP, from whom we received valuable input and with whom we tested our analysis. We have met with academics, industry representatives, stakeholders, including the DaneAge Association (Ældresagen in Danish, an organization that works to improve conditions for the elderly), and representatives from foreign pension funds. We have subsequently shared our analysis and tentative conclusions with many of those we met with and asked for their comments. David Lando, professor at the Department of Finance at CBS, reviewed the report and provided useful input. We are grateful to all for their contributions. We could not have completed our work in a satisfactory manner without the input from people outside ATP. However, the analysis and conclusions are our own and do not necessarily reflect their views.

We have had multiple meetings with ATP's Supervisory Board and ATP staff, and ATP has provided secretarial assistance. We met with the Supervisory Board on four occasions. The Supervisory Board has given us input on our mandate, commented on our analysis as it evolved, and reflected on our conclusions. The recommendations in our report are for the Supervisory Board to consider. The Supervisory Board has agreed to publish a version of our report with a few restrictions on information that could be used to the detriment of ATP. These restrictions do not alter the analysis or conclusions. ATP is a complex structure, and to understand it re-

quires input from those who administer it. We could not have done our work if ATP had not provided secretarial assistance at our request. We have been mindful of possible conflicts of interest. We are grateful to ATP's Supervisory Board and staff for their contributions, but the analysis and conclusions are our own and do not necessarily reflect the views of ATP. We are solely responsible for any errors or omissions.

3.3 Limitations to our report

ATP consists of two business units, an administrative unit and a pension fund unit; our report is about the pension fund unit. The administrative unit handles roughly two-thirds of the total welfare benefits and other payments made by the public sector to citizens of Denmark. The purpose of the pension fund unit, ATP Lifelong Pension, is to deliver stable pensions to almost all Danes participating in the labor market. In the remainder of the report, the name ATP will refer to ATP Lifelong Pension, since this is the only business unit falling within the focus of this report.

Our analysis and conclusions reflect our mandate—this is not a comprehensive review of ATP or ATP's product—and they reflect our background. Our focus is on the investment strategy of ATP given the legislation and fundamental decisions by the Supervisory Board. At the request of the Supervisory Board, we mention areas of the legislation and Supervisory Board decisions that have large costs for ATP's investment strategy, but this is not the focus of our work. Our focus is consequently not on the design of the ATP product. We are economists, and our analysis is guided by economic principles and economic literature. Strategies based on economic principles should be assessed against their performance, and if they fail, they should be revisited. There are also important communication issues that should play a role, for example, if strategies differ from those of peers.

The mandate also asks us to provide input on the communication of ATP's investment results, which is both an important and a complex issue. It is important and linked to our mandate for the assessment of the investment strategy, because it should provide the basis for the public's interpretation of ATP's performance. It is complex because ATP's performance must ultimately be assessed against its obligations, and these differ from most other pension funds. Good communication must be both understandable and truthful, and ATP is not alone among pension funds in searching for ways to effectively communicate the important issue of pensions. Pensions provide income when earnings from work decline in later life. Before retirement, most of us spend limited time understanding our pension arrangements. ATP and other pension providers have an obligation to make our pensions understandable. Our starting point is that pensions are a future source of income, not just another asset management product.

3.4 Deep dives

We have covered most aspects of ATP's investment strategy through deep dives, where ATP's staff has presented and we have questioned their presentations. The approach for the deep dives has been background readings, for example Supervisory Board memos, but also presentations on the topics. Typically, presentations and other material have been sent before the meetings, to facilitate better discussion. Finally, in many instances, we have asked for additional information that has led to subsequent meetings and further analysis and discussions.

The deep dives have covered the following topics:

- The Danish pension system and ATP.
- Benefits paid by ATP.
- Portfolio construction.
- Actuarial work and pension payments.
- Risk modeling and management.
- Implementation of investment strategy.
- Communication of investment results.
- Investment performance at the total portfolio level, portfolios corresponding to different liabilities associated with the ATP product, liquid asset classes, private market investments, and Danish equities.
- Illiquid assets, including performance, illiquidity premiums, sizing, asset allocation, and funding.
- Liquidity modeling.
- Danish equities.
- Use of leverage.
- Performance of risk models.
- Risk control and portfolio dynamics.
- Value creation.
- Hedging and treasury management.

- Asset liability management framework.
- Currency risk management.
- Detailed investment performance over the last few years, including 2020 and 2022.
- Contributions.
- Public discussions of ATP performance.
- Evaluation of other pension and sovereign wealth funds.
- Meetings with individual investment teams, amongst others Danish Equities, Global Direct Investments, Liquid Markets, and ATP Private Equity Partners.
- Environmental, Social, and Governance (ESG).

3.5 Insights from literature and other performance reviews

We have consulted performance evaluations of other pension funds and note that the simplest evaluations are not necessarily the best. A simple way to evaluate the performance of a pension fund is to look at the return on its investments, but this approach is too simplistic. Pension funds differ in terms of the portfolios they can invest in and in terms of their obligations to pensioners. A more sophisticated approach looks at the performance of the different portfolios, such as portfolios with different investment mandates. The most sophisticated approach (but also the most complicated) measures performance relative to obligations. We take all three approaches, but we believe that measuring performance relative to obligations should be the starting point. We note that the approach to performance reviews reflects the design of the funds and the public attention closely associated with that design. We have looked at the performance reviews for the following funds:

- Norway: Government Pension Fund Global (GPFG; Norway's sovereign wealth fund).
- Sweden: AP funds.
- The Netherlands: ABP and PFZW.

There are regular reviews of Norway's Government Pension Fund Global, Swedish AP funds, and Dutch pension funds.

We have also consulted the literature on investment management and note that while efficient markets are a good starting point, recent research suggests that there are possibilities to generate excess returns when using one's comparative advantages. The efficient market hypothesis

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is a strong theoretical proposition, and it provides important guidance on how to obtain good risk-adjusted returns. However, markets are not fully informationally efficient, which opens the possibility of generating excess returns. Discipline should nonetheless be exercised when exploring strategies that aim to do so. The full list of references we have drawn on is provided in the bibliography.

Chapter 4

Theory and practice of pension fund management

Pension fund investment management is about managing assets under uncertainty so that promised benefits to beneficiaries can be delivered. Because pension obligations are long-dated and often sensitive to interest rates, inflation, and longevity, investment policy is inseparable from the nature of the liabilities.

The goal of this chapter is to develop a unified framework of the theory and practice of pension fund investment management so that the benefits provided by ATP—especially the inflation indexation objective, ATP’s investment management, and governance framework—can be viewed in a broader context of academic theories and empirical evidence. We outline asset and liability management with a focus on balance sheet investing in Section 4.1. We discuss the characteristics of the menu of liquid and illiquid assets in Sections 4.2 and 4.3, respectively, but place more emphasis on illiquid assets, as these have grown significantly in institutional portfolios over the past few decades. We turn to the management of pure investment portfolios that do not have explicit liabilities attached to them in Section 4.4. We discuss how institutional investors implement investment management in practice in Section 4.5. We close with Section 4.6 on industry trends.

4.1 Asset and liability management

Key message

This section develops a framework for pension fund asset and liability management, grounded in the economic balance sheet and the funding ratio as the central measure of financial health.

We introduce the main pension plan structures—defined benefit, defined contribution, and hybrid designs—and identify the key risks on both sides of the balance sheet: longevity, inflation, and interest rate risk on the liability side, and investment risk on the asset side.

We discuss how an optimal investment policy breaks down into a speculative portfolio that seeks excess returns, and a hedging portfolio that matches the interest rate, inflation, and cash flow characteristics of the liabilities.

What counts as the risk-free asset depends on the nature and horizon of the liabilities, and we discuss practical hedging tools including duration matching, cash flow matching, and the use of interest rate and inflation swaps. In a dynamic setting, the allocation between speculation and hedging varies with the funding ratio, the investment opportunity set, and regulatory constraints, which may give rise to procyclical pressures that amplify market stress.

We close with capital requirements, such as those under Solvency II, that formalize the solvency buffers needed to withstand adverse shocks but must balance prudential objectives against the risk of procyclical forced selling. Together, these elements provide the analytical foundation for evaluating the investment management and governance of pension funds, including ATP, in the sections that follow.

Asset and liability management considers both assets and liabilities on an economic balance sheet, valuing each at market prices and focusing on their interaction over time. Assets are the market value of invested capital. Liabilities on an economic balance sheet are the present value of promised future payments, discounted using appropriate term structures that reflect interest rate, inflation, and longevity risks. A critical variable is the funding ratio, which is defined as the value of assets to the value of liabilities. The funding ratio summarizes the financial health of the pension fund and is an important state variable guiding investment, contribution, and risk-management decisions. Considering both assets and liabilities at market values ensures that the funding ratio reflects the current economic position of the fund, providing a consistent foundation on which investment and hedging decisions are made.

4.1.1 Economic balance sheets

The economic balance sheet of a pension fund values both assets and liabilities at market prices, revealing the true financial position of a pension fund and how well its assets cover its obligations. Consider an economic balance sheet of a pension fund. In an economic balance sheet, assets (A) and liabilities (L) are expressed in market values (not accounting values, recorded on the financial statements according to accounting standards). The liabilities are the present value of all future pension payments the fund is obligated to make to its members (current and retired employees). The assets are the values of cash and risky assets the pension fund invests in. If assets are greater than liabilities ($A > L$), the pension fund has a surplus; if assets are less than liabilities ($A < L$), the pension fund has a deficit. Thus, the surplus or funding ratio measures a pension fund's solvency.² Exhibit 4.1 illustrates the balance sheet with a positive surplus.

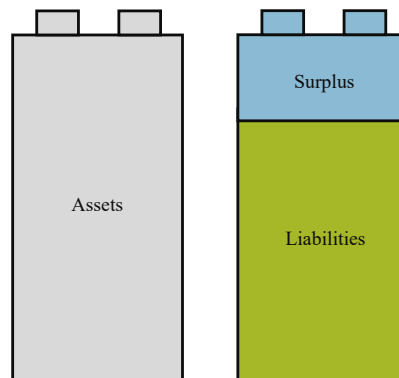


Exhibit 4.1: Assets, liabilities, and surplus of the economic balance sheet.

The surplus (S) equals the difference between the pension fund's assets and liabilities:

$$S = A - L.$$

The funding ratio (F) equals the ratio of assets to liabilities:

$$F = A/L.$$

The funding ratio measures how well the pension fund's assets cover its liabilities. It can be used to assess the adequacy of contributions to the fund. If the funding ratio is 1.0 (= 100 pct), the pension fund is fully funded; if the funding ratio is above 1.0 (> 100 pct), it is overfunded and has a surplus; if the funding ratio is below 1.0 (< 100 pct), it is underfunded and has a

²In pensions and insurance contexts the surplus is also referred to as "own funds" and liabilities are referred to as "technical provisions." The corresponding label for surplus on a corporate balance sheet is "equity," the difference between assets and debt.

deficit. Relatedly, solvency ratios discussed later also measure whether the pension fund could meet all its obligations. While there may be actuarial differences between funding and solvency ratios, they convey the same message in terms of market values.

Market valuation has several important advantages over accounting valuation. First, it provides a consistent, forward-looking measure of solvency: assets and liabilities are valued on the same basis, so the surplus and funding ratio reflect economic reality rather than accounting conventions that may smooth or delay the recognition of gains and losses. Second, market values respond promptly to changes in interest rates, inflation expectations, and asset prices, giving the fund and its supervisors a timely signal of emerging risks. Third, market valuation aligns the balance sheet with the prices at which assets could be bought or sold and at which liabilities could, in principle, be transferred or hedged, making the framework directly relevant for investment, hedging, and risk-management decisions. Fourth, by making the sensitivity of liabilities to interest rates, inflation, and longevity explicit, market valuation provides the foundation for the liability-driven investment approach developed later in this section.

4.1.2 Key risks: liabilities and assets

Key risks on the liability side of the balance sheet are longevity risk, inflation risk, and interest rate risk, while key risks on the asset side of the balance sheet are investment risks. These are explained below.

Key liability risks:

- **Longevity risk.** The promised pensions are lifelong and depend on the assumed mortality rates of the pension scheme members (so-called best estimate values). If members live longer than expected, the promised payments increase. The liabilities, the present value of the promised payments, then increase.
- **Inflation risk.** The promised pensions may be indexed to inflation to maintain the purchasing power of the benefits. If inflation becomes higher than expected, the promised payments increase. The liabilities then increase.
- **Interest rate risk.** The promised pensions (expressed in nominal terms) are discounted with nominal interest rates. Importantly, a nominal interest rate can be decomposed into a real interest rate, an expected inflation rate, and an inflation risk premium (see also Section 4.1.5 below). Movements in the three components result in movements in nominal interest rates. If interest rates become lower, the present value of the promised payments becomes higher. The liabilities then increase.

Key asset risks:

- **Investment risk.** The pension fund invests the contributions in various (risky) assets. The assets then obviously move with the (market) valuations of these investments. A fall in stock prices, bond prices (when interest rates move higher), and the valuations of the alternative assets will lower the asset values and decrease the funding ratio. In extreme cases, asset values can fall to zero; for example, when a company defaults and bondholders or shareholders recover nothing.

A critical consideration is whether the liabilities are guaranteed in real or nominal terms. A given pension payment today can increase at a fixed rate of interest, which corresponds to a nominal guarantee. The interest rate reflects expected inflation and a term spread (which, on average, increases with maturity; more on term spreads later). Although the nominal interest rate includes an inflation component, nominal guarantees are subject to *unexpected* inflation risk if realized inflation is different from the expected inflation embedded in nominal yields. If pension guarantees are indexed to inflation, then the pension benefit increases with realized inflation, though the quality of this protection depends on how closely the chosen price index tracks the actual consumption basket of beneficiaries. Whether the pension payments are guaranteed in nominal terms or real terms has first-order implications for asset allocation and hedging strategies, as the appropriate liability-hedging assets differ markedly between real and nominal obligations.

The four key risks—longevity, inflation, interest rate, and investment risk—affect the assets and liabilities, and thereby the surplus and funding ratio of the pension fund. The first three risks of longevity, inflation, and interest rate risks can all increase the present value of liabilities, threatening the solvency of a pension fund if not properly managed or hedged. Investment risk through adverse market movements can reduce asset values and thereby reduce the surplus or widen the funding deficit.

4.1.3 Pension plan structures

The contribution principle in pension funds governs how members contribute to and benefit from a pension scheme. There are two main designs, defined benefit and defined contribution, and they differ in who bears the investment and longevity risks.

In a defined benefit (DB) plan, pension payments are predefined and guaranteed by the sponsor (government or employer), making the liabilities long-term, predictable, and sensitive to interest rates, inflation, and life expectancy assumptions. In a DB pension scheme, members (the employees) receive a fixed stream of benefits beginning at their retirement and continuing until their death. The benefits are determined in advance and typically based on factors such

as each employee's final or average salary, years of service, and age, rather than based on investment performance. The benefits are lifelong. There could be protection against inflation through an indexation of the benefits to a particular price index (for example, a consumer price index). The liabilities of the DB plan are then the present value of those benefits the fund is obligated to make to its members. The benefits can be for actives (current employees, who are in the working phase and will receive pensions in the future), retirees (former employees, who are in the retirement phase and currently receive pensions), or deferreds (previous employees, who are not active members and may have moved to another employer and another plan). Calculations of the promised benefits use assumptions about relevant variables including interest rates, expected inflation, and life expectancy. Typically, the benefits have a long duration (say, 20 years or more). As these benefits are promised and guaranteed by the plan sponsor or through other insurance mechanisms, risk-free rates should be used to discount the expected benefits.³

The sponsor funds a DB plan through contributions (employees may or may not contribute as well). The sponsor contributes enough to keep the plan adequately funded. If the pension plan is overfunded with a sufficiently large surplus, there may be mechanisms such that the sponsor can pause contributions or increase benefits; if a pension plan is underfunded, there may be other secured assets backing the plan, mechanisms such that a recovery plan must be put in place for the pension fund to become fully funded, or benefits may be decreased. (We discuss capital requirements and regulation in Section 4.1.7.) The contributions to the plan are invested in financial assets. These assets include traditional asset classes such as equities and fixed income securities, which we discuss in Section 4.2, but also non-traditional or alternative assets, such as hedge funds and private assets (including private equity, private debt, and real estate and infrastructure investments, discussed in Section 4.3). The assets also include holdings in cash. The sponsor bears the investment risk and must ensure that the plan has enough assets to pay promised benefits.

In a defined contribution (DC) plan, the contributions are made by the employer, employee, or both, to an individual account, and the retirement income depends on the accumulated contributions and the investment returns earned on them. Here, the member bears both the investment risk and, upon retirement, the longevity risk. As a result, pure DC plans generally lack collective risk-sharing across participants over time, and they do not involve institution-level surplus management.

An important distinction is whether a pension plan is funded or unfunded. In a funded plan, contributions are invested in a pool of assets that back the promised benefits, and the financial

³Here there is a significant difference between an economic balance sheet and an accounting balance sheet, as for accounting purposes expected benefits are typically discounted with yields on high-grade corporate bonds.

health of the plan can be assessed through its economic balance sheet. In an unfunded or pay-as-you-go (PAYG) plan, current benefits are paid directly from current contributions with no assets set aside. The sustainability of a PAYG system therefore does not depend on investment returns but on the ongoing capacity of the contributor base to fund promised benefits, which makes the ratio of active contributors to retirees a central determinant of financial viability. Demographic shifts like population aging, declining birth rates, and rising life expectancy place pressure on PAYG systems and typically require adjustments to contribution rates, benefit levels, or retirement ages (Börsch-Supan, Härtl, and Leite, 2016). The implicit asset backing PAYG promises is the future taxing power of the government or the future contribution capacity of the workforce, neither of which is a tradeable financial claim. Many public pension systems around the world operate on a pay-as-you-go basis, whereas occupational pension funds are often funded (OECD, 2025). Other public pension systems are notional defined contribution (NDC) plans, where members have individual accounts that accrue at a specified rate but actual benefit payments are made on a PAYG basis. The asset and liability management framework in this section applies to funded plans, where the balance sheet, the funding ratio, and the surplus are well defined.

In practice, many pension plans blend elements of both DB and DC designs. A DC plan with a minimum return guarantee, for example, resembles a DB plan in that the guarantee creates a liability floor that must be hedged or reserved against. From a balance-sheet perspective, the guaranteed component behaves like a DB obligation (its present value is sensitive to interest rates and must be matched with appropriate hedging assets) while the upside beyond the guarantee retains the DC character of depending on realized investment returns. This observation implies that the asset and liability management tools developed in this section are relevant not only for traditional DB plans but also for DC plans with guarantees.

Pension plans can be organized on an individual or collective basis, and collective arrangements introduce important elements of risk-sharing and pooling. In a collective plan, contributions from all members are pooled into a single fund, and benefits are paid out from this common pool. This structure enables risk-sharing across generations: investment gains and losses can be spread over current and future members through adjustments to contribution rates, benefit indexation, or buffer reserves. Pooling also mitigates individual longevity risk, since the fund insures members against the uncertainty of their own lifespan—those who live longer than expected are effectively subsidized by those who do not. The welfare gains from longevity pooling can be substantial: for risk-averse individuals, the consequences of outliving one's savings are typically far more severe than the loss of leaving unspent assets behind, so a lifelong annuity is worth more than its actuarially fair cost (see, for example, Yaari, 1965, for the foundational result, and Davidoff, Brown, and Diamond, 2005, for results in a general setting).

Collective arrangements can therefore achieve welfare gains that are unavailable to individual DC accounts, but they also introduce governance challenges around the equitable distribution of surpluses and deficits across generations. An important distinction is that in a collective DC plan, these adjustments fall on the members themselves rather than on a sponsor, as would be the case in a traditional DB plan. Benefits and inflation indexation are therefore not guaranteed but instead depend on the financial health of the pension fund (typically measured by its funding ratio). The design of intergenerational risk-sharing rules is therefore a central issue in pension fund governance and regulation.

In the terminology introduced here, ATP can be seen as a fully funded, collective DC plan with a guarantee, which we will detail in Chapter 5 and further sections below. The contributions are fixed amounts determined by the ATP Act, and members' pension rights are accrued on a "what-you-pay-is-what-you-get" basis. The guarantee consists of the pension rights accrued being nominal lifelong annuities—once a pension right is earned, it cannot be reduced. The plan is collective, as all members' contributions are pooled into a single fund and risks are shared.

With the plan structures and their balance sheet implications established, we next consider the key risks facing a DB plan or a DC plan with a guarantee.

4.1.4 Portfolio choice problem and solution

Pension fund investing must consider both assets and liabilities together. The objective is to manage the surplus or funding ratio, not just maximize asset returns given their risks. The optimal portfolio combines a speculative demand, seeking returns, and a hedging demand, stabilizing liabilities; the mix depends on the fund's risk preferences.

How should the pension fund invest? Standard treatments of investing are asset-only investments where the objective is often a function of future wealth (for example, maximizing the expected utility of future wealth), leading to a trade-off between expected returns on assets and their risks. The main difference for pension funds is that they need to consider the entire balance sheet, both assets (A) and liabilities (L), when investing. This is sometimes referred to as asset liability management (ALM) or liability-driven investment (LDI). The objective is typically expressed in terms of the surplus ($S = A - L$) or the funding ratio ($F = A/L$), which leads to a trade-off between expected returns on both assets and liabilities and their risks. Importantly, it involves the covariation between assets and liabilities and how assets match liabilities; for example, volatility in the funding ratio can be seen as a mismatch risk between assets and liabilities.⁴

⁴See [Leibowitz \(1987\)](#) and [Sharpe and Tint \(1990\)](#) for a discussion of surplus management, and [Hoevenaars](#)

In a DB pension plan, the liabilities are already promised and defined so they are taken as given for the pension fund. Consider a pension fund that invests its assets while accounting for its liabilities. In economics terms, the liabilities are *exogenous*. That is, the pension fund chooses its assets given its liabilities.⁵ Consider first a static setting in which there is an investment during one period, between today (date t) and the future (date T). The static setting can be motivated by the assumption of independence between investment periods during the investment horizon. While the investment horizon could be one year, ten years, or longer, there is only one investment decision in this static setting. Later we comment in Section 4.1.6 on an extension to a dynamic setting where investment decisions are taken on every date over the investment horizon (at dates $t, t + 1$, etc.).

*Under some common technical assumptions, it is straightforward to show that the optimal portfolio weights of risky assets can be decomposed into a speculative demand and a hedging demand.*⁶

$$\text{Optimal portfolio} = (1/\gamma) \times \text{Speculative portfolio} + (1 - 1/\gamma) \times \text{Hedging portfolio}.$$

The optimal portfolio is a weighted average of a speculative portfolio and a hedging portfolio. The speculative portfolio is the traditional mean-variance optimal portfolio. It is determined by variances, covariances, and expected returns of the risky assets. It aims to increase expected returns subject to their risks and correlation structure. The decomposition of the total portfolio into speculative and hedging demand resembles the decomposition in Merton (1971) and Merton (1973) in a dynamic context and other portfolio decompositions reviewed in Campbell and Viceira (2002) for asset-only investing. In those contexts, the hedging demand usually arises due to changes in the investment opportunity set. Here it arises due to the nature of liabilities. The hedging portfolio is determined by covariances between liabilities and risky assets.

The relative emphasis on the speculative portfolio versus the hedging portfolio depends on a risk aversion parameter. The risk aversion parameter, γ , captures the curvature of the power function over the funding ratio. It can be interpreted as a preference parameter. The more con-

et al. (2008) for an asset allocation analysis using the funding ratio.

⁵This portfolio choice problem is different from the problem of say a bank, which chooses both its assets and its liabilities—for example, a bank can change the interest rate it charges for loans (assets) and can also change the demand for deposits (liabilities) by setting deposit rates. In economics terms, the bank's liabilities are *endogenous*.

⁶Specifically, that the objective is to maximize the expected power function over the funding ratio and that returns on assets and liabilities are lognormally distributed. (The power utility function is a workhorse model in finance and economics.) There are other studies which use other functions of surplus or funding ratios including avoiding drawdowns in shortfalls (funding ratios below a certain threshold) (Detemple and Rindisbacher, 2008), incorporating constraints for drawdowns of liabilities relative to asset values (Berkelaar and Kouwenberg, 2010; Martellini and Milhau, 2012), value-at-risk measures (Bogentoft, Romeijn, and Uryasev, 2001; van Binsbergen and Brandt, 2007), and downside risk aversion (Ang, Chen, and Sundaresan, 2013; Dahlquist, Farago, and Tédongap, 2014). A different approach is described by van Binsbergen, Brandt, and Kojien (2008), who consider optimal decentralized investments, where the benchmark can be viewed as liabilities.

cerned the pension fund is about movements in the funding ratio, the more weight the fund puts on the hedging portfolio. There are two interesting special cases. First, if the curvature parameter equals one, the optimal portfolio equals the speculative portfolio. This can be viewed as a case when the fund only cares about the assets and abstracts from the liabilities. Second, if the curvature parameter becomes infinitely large, the optimal portfolio equals the hedging portfolio. This can be viewed as a case when the fund only cares about the stability of the funding ratio.

In theory, the hedging portfolio is the portfolio of assets that best hedges movements in the liabilities. The liabilities can be perfectly spanned by traded assets in so-called *complete* markets. In practice, pension fund liabilities are not fully hedgeable because markets are incomplete. Longevity risk, long-dated real interest rate risk, and inflation risk may not be perfectly replicated by traded securities, especially for long-dated pension claims where there is a dearth of risk-free very long-maturity bonds. In this case of *incomplete* markets, the hedging portfolio is the minimum-variance hedge of liabilities using available assets, rather than a complete hedging strategy of the liabilities.

In practice, the hedging portfolio is the asset portfolio that best matches the liabilities. This will be different in different situations. For example, if the liabilities can be characterized as a nominal (real) bond, the best match on the asset side is a nominal (real) bond. Technically, the hedging portfolio's weights in the risky assets are the coefficients in a regression of the return on the liabilities on the returns on the risky assets.⁷ The effectiveness of the hedging is captured by the *R*-squared in the regression.

Taken together, the assets can be decomposed into those given by the speculative portfolio and those given by the hedging portfolio. Exhibit 4.2 illustrates how the assets can be thought to be divided into speculative assets and hedging assets. Hence, the optimal portfolio combines two objectives: speculative demand pursues higher expected risk-adjusted returns, while the hedging demand protects against movements in liabilities. The parameter γ in the equation above governs how much emphasis the fund places on the speculative and hedging demands. However, it is not necessarily the case that hedging is implemented such that value of the hedging portfolio equals the liabilities (and thereby the value of the speculative portfolio equals the surplus); for example, derivatives may be used to hedge the liabilities (as discussed below).

⁷If markets are complete, the *R*-squared would equal one.

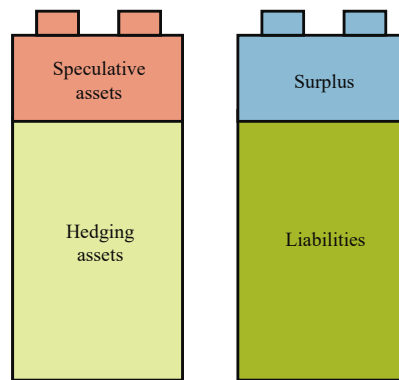


Exhibit 4.2: Aligning assets with liability structure.

4.1.5 Risk-free asset

What counts as “risk-free” depends on the nature of liabilities and the investment horizon: long-term nominal or real bonds can be risk-free even if volatile in the short term. In a short-term investment problem, cash (investments in liquid short-term financial instruments with little default risk) is typically considered risk-free. However, suppose the liabilities are long term and nominal. In this long-term investment, cash needs to be rolled over, and the reinvestment risk makes cash risky. Instead, investments in a default-free long-term bond with no coupon payments may exactly match the investment horizon and thereby be seen as a risk-free asset. Note that fluctuations in the price of the bond can be substantial in the short term, whereas in the long term it can be seen as risk-free. In practice, long-term bonds pay coupons (typically paid every six months or every year), and there is reinvestment risk of the coupon payments.

If the liabilities are long term and real, an inflation-indexed bond (a real bond, where payments increase with inflation) can be seen as a risk-free asset. With inflation, a nominal bond is far from risk-free. If there are unexpected inflation shocks, the purchasing power of the nominal cash flows is eroded. However, in practice, the market for real bonds is thin. What can substitute for a real bond? Importantly, inflation shocks tend to be persistent. This means that high unexpected inflation in the next period tends to be followed by high inflation the period thereafter and for a while. It also means that expected inflation will be higher, driving up nominal interest rates. An investment in nominal long-term bonds then suffers, but an investment in cash over a longer horizon will benefit from higher roll-over rates. Cash may (imperfectly and with a lag) thus substitute for long-term real bonds.

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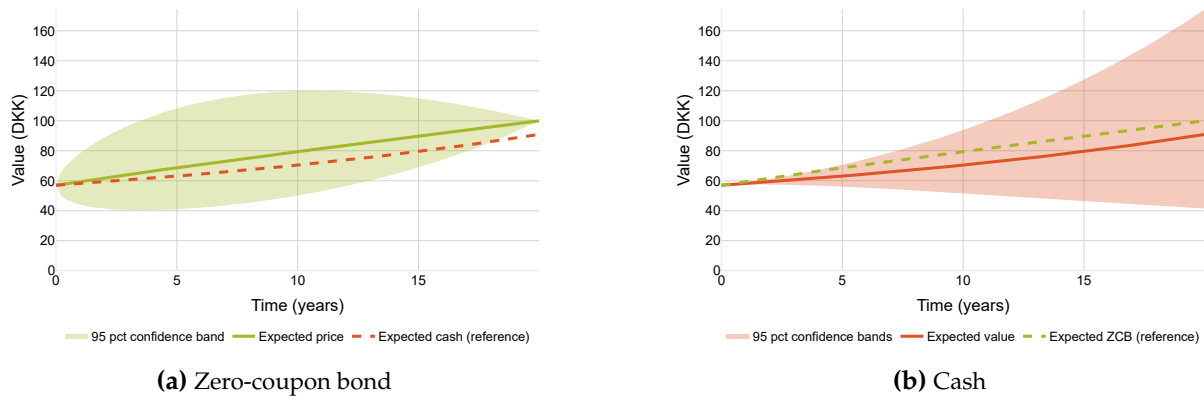


Exhibit 4.3: Zero-coupon bonds as the long-term risk-free asset. Panel (a) plots the distribution of an investment in a 20-year zero-coupon bond (ZCB) over 20 years; similarly, Panel (b) plots the value-distribution of an investment in cash over 20 years.

Exhibit 4.3 illustrates why only a 20-year zero-coupon bond is risk-free for an investment horizon of 20 years. Panel (a) plots the distribution of the price of a 20-year zero-coupon bond for different future interest rates and thereby future values. The price is initially around 57 and pulls to par of 100 at maturity. Importantly, the 20-year zero-coupon bond is risky in the short and medium term, as indicated by the 95 pct confidence band for future values, but it is risk-free and equal to 100 in the long term (here at the 20-year horizon). This panel also plots the expected price of the bond as it matures. The trend (the expected return) is assumed to be higher than for cash. Similarly, Panel (b) plots the distribution of the value of cash. It is risk-free in the short term but becomes increasingly risky with an increasing horizon. This panel also plots the expected value of cash, which again is lower than the expected value of the bond. Note that higher future interest rates lead to lower future bond prices and higher future values of cash, whereas lower future interest rates lead to higher future bond prices and lower future values of cash. The risk (in the short and medium term) for the zero-coupon bond is referred to as price (or market) risk; the risk for cash is referred to as reinvestment risk. Note that price and reinvestment risks act in opposite directions.

A coupon-paying bond has both price and reinvestment risk. The standard risk metric that captures the balance between price and reinvestment risk is *duration*. Duration is a generic label that comes in different forms. Three common measures are Macaulay duration, dollar duration, and modified duration. Macaulay duration measures when the average cash flow is received; it is the average time to receive those cash flows, with each cash flow weighted by its present value. The dollar and modified durations are first-order approximations of the absolute price change and percentage price change, respectively, when interest rates change. Assuming a flat term structure of interest rates at 2.5 pct, a 20-year bond with annual coupons at a coupon rate of 2.5 pct has a price of 100 (at par), a Macaulay duration of 15.98 years, a dollar duration of 1,558.9, and a modified duration of 15.59. The Macaulay duration therefore says that the

present-value-weighted average timing of the bond's cash flows is close to 16 years, and the dollar and modified durations say that the absolute price change and percentage price change for a one percentage point change in interest rates are 15.59 dollars and 15.59 pct, respectively.

Duration measures are commonly used for hedging. For example, if a pension fund has liabilities with a certain duration, the hedging assets can be constructed such that they have the same duration. The hedging assets then have the same interest-rate sensitivity as the liabilities, and to a first-order approximation the assets move one-to-one with liabilities. Dollar and modified duration do not account for higher-order terms in the price sensitivity approximation or non-parallel movements in the term structure of interest rates. However, more sophisticated metrics exist to capture higher-order effects (such as convexity) and non-parallel movements (such as key-rate or factor duration measures). Importantly, duration-based hedging requires periodic rebalancing as time passes.

Cash flow matching is a more exact approach to hedging liabilities, where a portfolio of bonds is constructed such that the portfolio cash flows replicate the liabilities. Rather than matching the first-order sensitivity of assets and liabilities to interest rate changes, as in duration matching, cash flow matching eliminates both price and reinvestment risk by ensuring that the timing and amount of each asset cash flow coincides with the corresponding liability payment. In the simplest case, a portfolio of zero-coupon bonds can be used to match each liability cash flow exactly. In practice, the set of available zero-coupon bonds may be limited, and coupon-paying bonds are used instead, which requires solving a portfolio construction problem. When feasible, cash flow matching has the advantage that it does not require rebalancing as time passes, whereas duration matching is a first-order approximation that must be rebalanced periodically to remain effective. However, cash flow matching can be more costly: by requiring each cash flow to be matched, it forgoes the flexibility inherent to duration matching to substitute among bonds of equivalent duration, including those offering higher expected returns.

Interest rate swaps provide a flexible and liquid alternative to bonds for adjusting the duration of the asset portfolio, particularly when the supply of long-term bonds is insufficient to match the duration of liabilities. In a plain vanilla interest rate swap, one party pays a fixed rate and receives a floating rate, or vice versa. A receiver swap (receiving fixed, paying floating) adds duration to a portfolio, as the present value of the fixed leg is sensitive to interest rate changes in much the same way as a long-term bond. Conversely, a payer swap (paying fixed, receiving floating) reduces duration. Since swaps do not require an upfront purchase of bonds, they allow pension funds and insurance companies to achieve the desired duration exposure without being constrained by the availability or cost of long-term bonds in the cash market. This is particularly relevant when liabilities extend several decades into the future and their

duration exceeds what can be readily obtained through bond portfolios alone. In practice, a combination of bonds and swaps is often used: the bond portfolio provides the base return and cash flows, while the swap overlay fine-tunes the duration to match the liability profile. However, swaps introduce counterparty risk and require collateral management, which adds operational complexity relative to a pure bond-based strategy.

Finally, when liabilities are in real terms, inflation swaps can be used to hedge the inflation exposure. In an inflation swap, one party pays a fixed rate and receives the realized inflation rate, or vice versa. A pension fund or insurance company with real liabilities can enter into a receiver-inflation swap, effectively converting nominal asset returns into real returns. This achieves a similar effect to holding inflation-indexed bonds but without requiring the purchase of the bonds in what is often a thin market. As with interest rate swaps, inflation swaps introduce counterparty risk and collateral requirements, and the market for longer maturities may be less liquid than for interest rate swaps.

4.1.6 Dynamic setting: protecting liabilities

In a dynamic setting, liability protection becomes an ongoing rebalancing problem rather than a one-time portfolio choice. The key concepts of a hedging portfolio to match liabilities and a speculative portfolio to harvest excess returns carry over from the static to the dynamic setting, but the optimal weights in both portfolios now vary through time. As the liabilities and the investment opportunity set change, the allocation between hedging and speculation must be continuously updated.⁸ The funding ratio itself becomes a state variable: as it rises or falls, the pension fund's capacity to bear speculative risk changes, and so does the urgency of maintaining the liability hedge. Investment opportunities—expected returns, volatilities, and correlations—may also vary over time, introducing an additional time-varying component in the speculative portfolio. In the dynamic setting, the pension fund solves a sequence of inter-related asset and liability problems, recognizing that today's investment decision affects tomorrow's funding ratio and the constraints of meeting today's liabilities also affect tomorrow's investment returns (van Binsbergen and Brandt, 2016).

Dynamic protection of the liabilities

Black and Jones (1987) and Black and Perold (1992) develop a dynamic approach to protecting a minimum wealth floor known as constant proportion portfolio insurance (CPPI). Under CPPI, the fund takes more investment risk when assets are safely above the floor and reduces risk as assets approach the floor. In more technical language, CPPI is a portfolio rule that allo-

⁸The optimal weights may differ across horizons because the per-period variances, covariances, and expected returns can themselves be horizon-dependent.

cates a fixed multiple of the surplus above a specified floor to risky assets, with the remainder invested in risk-free or liability-matching assets. In the ALM context, the natural benchmark for the floor is the present value of the liabilities, L , or equivalently the asset value corresponding to a funding ratio of one. The difference between the current asset value, A , and the floor, L , is the cushion or the surplus $S = A - L$ developed in Section 4.1.1. The closer assets move toward the floor, the more the portfolio shifts toward risk-free assets or liability-matching assets; the larger the cushion, the greater the capacity to invest in return-seeking assets. CPPI makes the speculative allocation explicitly dependent on the state of the balance sheet—as the surplus increases, the fund takes on more speculative risk; as the surplus decreases, the speculative allocation shrinks to protect the floor. [Leland \(1980\)](#) shows that the dynamic rebalancing between the speculative and hedging portfolios is equivalent to purchasing portfolio insurance—the fund systematically buys protection against states of the world in which the liabilities cannot be met.

The CPPI rule has an important property: it is procyclical with respect to market prices, so CPPI strategies sell risky assets as prices fall. As asset prices decline, the surplus shrinks, and the CPPI strategy de-risks because the fund's capacity to bear risk has diminished. This means that a pension fund implementing CPPI sells risky assets into a falling market. A prominent example of *de facto* procyclicality, resembling that of a CPPI strategy, occurred in the UK in September 2022. Following the announcement of the unfunded “mini-budget,” gilt prices fell sharply. Defined benefit pension schemes using liability-driven investment (LDI) strategies—which hedge the interest-rate sensitivity of pension liabilities using derivatives and leverage—then faced large collateral calls, forcing them to sell gilts and other liquid assets in a falling market. This led to a self-reinforcing spiral of deleveraging that was stopped only by the intervention of the Bank of England ([Chen and Kemp, 2023](#)).⁹

Regulatory funding frameworks can also impose procyclical CPPI-like strategies to ensure that pension liabilities can be met. In the Netherlands, the funding ratio of pension plans fell from above 1.4 in 2007 before the financial crisis to below 1.0 during and after the financial crisis. When funding ratios deteriorated, underfunded funds were required to adopt recovery measures, which included higher contributions, suspension of indexation, and, in some cases, cuts to pension rights ([Haan, 2015](#)). In this way, the regulatory framework decreased funds' effective risk-bearing capacity after adverse shocks to preserve the guaranteed benefits. (We further discuss capital requirements and procyclicality in Section 4.1.7)

⁹See also [Pinter, Siriwardane, and Walker \(2024\)](#) for the forced sales of risk-free assets by LDI funds in this period.

Intertemporal surplus management

Intertemporal surplus management extends the static asset–liability framework by recognizing that pension funds must choose portfolios today considering how those choices affect future funding positions, future constraints, and future investment opportunities. [van Binsbergen and Brandt \(2016\)](#) model a pension fund that must trade off the long-term objective of maximizing the expected funding ratio and satisfying short-term regulatory risk constraints—such as a minimum funding ratio or a Value-at-Risk (VaR) limit—at each point in time. When there are time-varying expected returns and volatilities, the optimal speculative portfolio is no longer a fixed mix of risky assets but shifts with the state of the economy. Further, the current funding ratio, which reflects the short-term risk constraints, interacts with the investment opportunity set: a fund with a high funding ratio can afford to tilt the speculative portfolio toward assets with high expected returns even if they carry substantial short-term risk, whereas a fund near its regulatory floor must forgo attractive but volatile opportunities in order to satisfy the binding constraint to meet the fund's liabilities. In [Rudolf and Ziemba \(2004\)](#), the pension fund maximizes expected utility of surplus over multiple periods, and the optimal policy depends both on the current surplus and on how today's investment decisions alter the distribution of future surpluses and hence the fund's future ability to take on risk. Thus, dynamic pension fund management requires tracking the funding ratio, the liability structure, and the investment opportunity set. Note that the dynamic setting also affects the choice of risk-free asset discussed in Section 4.1.5: as the liability structure evolves over time, so does the composition of the hedging portfolio required to match it.

4.1.7 Capital requirements

Insurers and pension funds promise payments that may occur many years into the future and are therefore exposed to various financial and demographic risks. Regulators are concerned about the solvency of pension funds and insurers. To ensure that these institutions can meet their obligations even under adverse conditions, regulators require them to hold sufficient capital buffers. A key part of this regulation is therefore the specification of capital requirements. The basic idea can be illustrated using the balance sheet of a pension fund or insurer.

Inspired by the regulatory framework Solvency II, we next illustrate how risk-based capital requirements can be determined. Consider again the balance sheet of a pension fund in Exhibit 4.4. On the left side of Panel (a) in Exhibit 4.4, the balance sheet from Exhibit 4.1 is repeated with the surplus in light blue. Next, consider adverse movements in the underlying risk sources leading to a decrease in assets (for example, a drop in valuations of equities, real estate, etc.) and increase in liabilities (for example, caused by lower interest rates, higher realized inflation, or longer life expectancy). These stress scenarios produce the stressed balance

sheet shown on the right side of the exhibit. The stressed surplus is red. Panel (b) of Exhibit 4.4 shows the surplus with regulatory capital requirements, which provide a buffer for losses. The capital requirements specify the amount of capital that institutions must hold to remain solvent under severe but plausible stress scenarios.

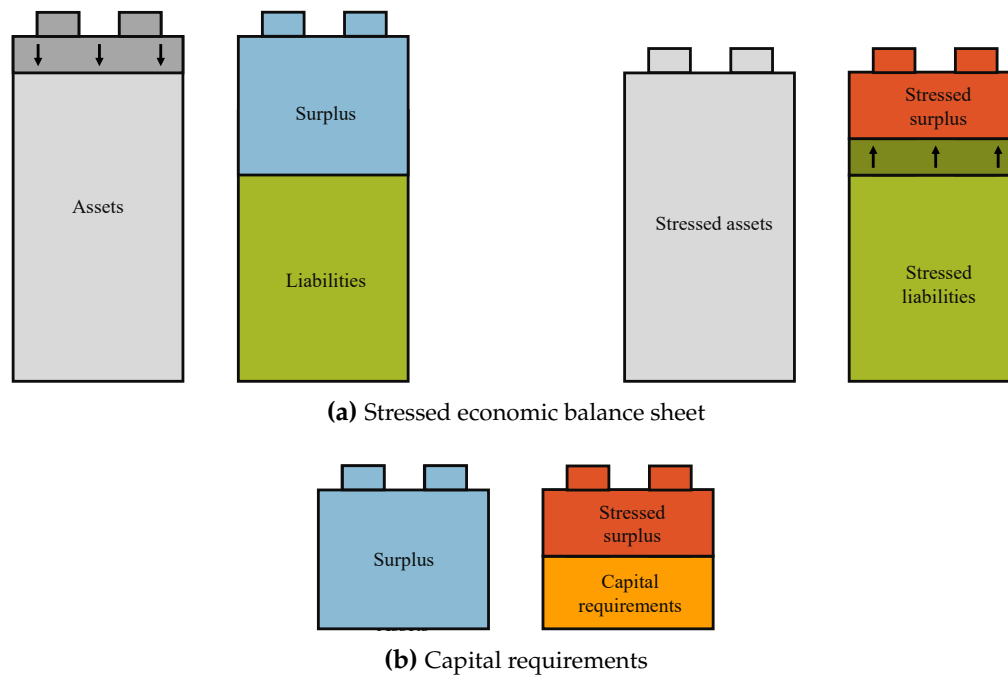


Exhibit 4.4: Stressed economic balance sheet and capital requirements. Panel (a) illustrates the stressed economic balance sheet (a decrease in assets and an increase in liabilities); Panel (b) illustrates the required capital necessary to stay solvent (meeting minimum requirements) after adverse moves in assets and liabilities. In Solvency II, the surplus is referred to as “own funds.”

In the EU since 2016, Solvency II is the regulatory framework for insurance and reinsurance companies. It is built on three pillars: quantitative requirements (for valuations of assets and liabilities and capital requirements), qualitative requirements (for governance and risk management), and reporting and transparency standards. The European Insurance and Occupational Pensions Authority (EIOPA) develops technical standards and ensures supervisory convergence, while national supervisory authorities are responsible for direct supervision for insurers under Solvency II.¹⁰

In Solvency II, the key capital measures are the Solvency Capital Requirement (SCR) and the Minimum Capital Requirement (MCR). SCR is the amount of capital needed to survive a 1-in-200-year shock. It is based on a VaR measure at the 99.5 pct confidence level over one year. The one-year horizon reflects the idea that regulators reassess the solvency position of insurers on a regular basis. Even though liabilities can extend several decades into the future, the

¹⁰Relatedly, in the EU, the regulatory framework for single-employer pension funds is IORP II (Institutions for Occupational Retirement Provision). In Denmark, most pension funds are regulated under Solvency II, though a small subset falls under IORP II depending on their legal structure.

solvency test evaluates whether the insurer will remain solvent over the coming year under severe but plausible shocks. If not, supervisors and the insurer can take corrective actions such as raising additional capital or adjusting investment strategies. The one-year horizon therefore combines a forward-looking risk assessment with the assumption that management actions and supervisory intervention can occur over time. The VaR measure considers scenarios for various modules, including market risks (such as interest rate, equity, property, spread, currency, and concentration risks) and life-related risks (including longevity risk). The standard formula specifies stress scenarios for risk submodules (for example, interest rate and equity), considering diversification effects between the submodules. Institutions subject to Solvency II can compute the SCR using either the standard formula or an approved internal model (own model); see [EIOPA \(2014\)](#) for details on the standard formula. Economically, the SCR is the capital buffer required for assets to exceed liabilities even after severe adverse shocks and corresponds to the capital requirement in the exhibit (in blue). MCR is the absolute minimum level of capital needed to remain solvent. If the insurer falls below this, regulators can intervene heavily.

Based on SCR and MCR, the key solvency ratios are the SCR ratio (equal to own funds divided by SCR) and the MCR ratio (equal to own funds divided by MCR). The SCR and MCR ratios must be above 100 pct. An SCR ratio below 100 pct triggers supervisory intervention and requires a recovery plan. Although the legal threshold is 100 pct, supervisors typically expect insurers to operate with a management buffer above 100 pct. An MCR ratio below 100 pct could trigger a withdrawal of the insurer's license, a forced portfolio transfer, or a resolution/liquidation.

Solvency II can impose pro- or countercyclical investment behavior. More broadly, capital regulation can generate procyclical pressures when falling asset values and rising liability values weaken balance sheets and solvency ratios. This can create pressure to de-risk or sell assets during periods of stress. Consider a pension fund with only a partial hedge of its liabilities so that its assets have shorter duration than its liabilities, leaving it exposed to interest-rate risk as well as equity risk. In a scenario like August 2011, when equity markets fell and interest rates declined, the funding ratio would deteriorate and could induce the fund to de-risk by selling equities and buying bonds. If many pension funds are in a similar position, such behavior can amplify market movements by pushing stock prices further down and bond prices further up, thereby creating additional pressure to de-risk. Another example is the previously mentioned LDI episode in September 2022 in the UK, where rising interest rates led to falling gilt prices, and margin calls led to liquidity demands and selling of gilts, which then put further pressure on gilts, in a vicious cycle. These mechanisms are consistent with the liquidity spirals described by [Brunnermeier and Pedersen \(2009\)](#), in which deteriorating market liquidity and

tighter funding conditions reinforce one another, increasing fragility and systemic risk. While Solvency II is market-consistent and can therefore generate procyclical pressures, it also includes tools specifically designed to limit them, notably the volatility adjustment, the matching adjustment, the symmetric adjustment to equity risk, and, in exceptional cases, an extension of the recovery period and transitional measures.

Solvency II is designed for pension funds that have some form of guarantees towards their members and not for pure DC schemes, where the own funds carries no or little risk and all the risks lie with the future and present pensioners. The own funds do not protect pensions in DC schemes from market risks and longevity risk. These risks are passed directly through to members in the plan. It is the responsibility of DC fund managers to limit risks to their pensioners if there is not a regulatory regime that does so. DC pension funds can link their investment policies to the pension that they want to deliver to their pensioners and the risk to that pension (see also Section 4.6).

Solvency II does contain the more general prudent person principle, which also applies to DC plans. Funds should act in the interests of present and future pensioners, with investment strategies that support the fund's long-term objectives, including securing the best possible returns, and that are robust to financial market volatility. A fund must only invest in assets for which it is capable of identifying, measuring, monitoring, managing, controlling, and reporting on the associated risks.¹¹

4.2 Liquid assets (or public market investments)

Key message

Liquid assets—equities and fixed income—are the core building blocks of pension portfolios. Equities provide long-run risk premiums but are volatile. Fixed income is more suitable for hedging pension liabilities, and we discuss how interest rate and inflation swaps allow pension funds to fine-tune duration and inflation exposures beyond what cash bond markets can provide. By being liquid, having observable market prices, and trading frequently, equities and fixed income can be rebalanced to optimal targets to maintain diversification and control risk while earning a return premium.

Liquid assets, or public market investments, form the core of most pension fund portfolios. The two most important liquid asset classes are equities, which provide the long-term risk premium necessary for asset growth, and fixed income, which serves as the fundamental tool for hedging liability-driven risks. This means that, in the framework of Section 4.1.4, equities may be the

¹¹See, for example, [Danish Financial Supervisory Authority \(2024\)](#).

primary component of the speculative portfolio and fixed income the primary component of the hedging portfolio. In this section, we analyze the strategic role of equities and bonds within a pension balance sheet context. We keep this analysis concise and place more emphasis on illiquid assets in the subsequent section.

4.2.1 Equities

While equities are a mainstay of institutional portfolios, this only took hold in the first half of the 20th century. As [Dimson, Marsh, and Staunton \(2002\)](#) document, an important step in this development was the publication of Edgar Lawrence Smith's (1924) book, *Common Stocks as Long Term Investments*. Prior to this, equities were viewed as too speculative and unsuitable for most institutional investors.

A formal justification for the equity risk premium began with [Mehra and Prescott \(1985\)](#). They found that the magnitude of the equity return relative to risk-free assets was much too high to be explained by standard economic models (a representative agent with power utility over a single consumption good). This article motivated a large subsequent literature proposing that the equity premium was high because agents had richer preferences or there were more complicated cash flow dynamics than in the original framework.

Equities have also exhibited historically high volatility. The volatility of equities has exceeded what can be justified by movements in dividends, earnings, or macroeconomic fundamentals—the so-called [Shiller \(1981\)](#) excess-volatility puzzle. Consequently, investors may experience prolonged periods—often a decade or more—where equities underperform risk-free assets. [McQuarrie \(2024b\)](#) recently shows that multi-decade periods of equity underperformance are not anomalies but recurring features of financial history. This long-horizon perspective is particularly relevant for pension funds: while equities offer a high long-run premium, their high volatility and long drawdowns imply that equities are not suitable for hedging fixed liabilities and pension funds need appropriate governance mechanisms to stay the course.

An enormous literature has documented that expected returns on equity vary over time because valuations, risk aversion, and macroeconomic conditions change (see [Ang, 2014](#), for a summary). Equity returns are hard to predict, but when equity prices are high relative to dividends, earnings, or book values, subsequent long-horizon returns tend to be lower; when valuations are depressed, expected returns tend to be higher ([Campbell and Shiller, 1988](#)). This time variation in expected returns is the reconciliation of Shiller's excess-volatility puzzle: prices move more than the present value of future dividends because expected returns themselves move—when prices fall, future expected returns rise (or, equivalently, discount rates rise). There are two practical implications for pension funds. First, capital market as-

assumptions used in strategic asset allocation should be revisited periodically rather than treated as time-invariant constants (see Section 4.4.1). Second, because expected returns mean-revert, the long-horizon investor's optimal equity allocation differs from the one-period investor's: a long-horizon pension fund bears less per-period volatility risk in equities than a short-horizon pension fund and can therefore allocate more to equities—points developed further in Section 4.4.2.

Global equities

While the US currently represents the dominant share of global market capitalization at 63 pct as of December 2025, the historical record shows that market weights have markedly changed over time. [Dimson, Marsh, and Staunton \(2020\)](#) observe that at the start of the 20th century, the UK equity market was the world's largest. At its peak in 1989, Japan accounted for 40 pct of the world index, compared with 29 pct for the US. This shows why a global perspective matters: relying solely on a single domestic market exposes a fund to significant “country risk.” In extreme cases, investors have lost all their money invested in domestic stock markets (for example, Russia and China in the early 20th century).

In modern financial theory, the logical starting point for any institutional portfolio is the global market portfolio. If markets are frictionless and complete, holding the world market is theoretically optimal as it maximizes diversification benefits ([Solnik, 1974](#)). Nevertheless, a persistent “home bias” remains: investors consistently allocate a higher proportion of capital to domestic assets than their market-cap weight would suggest ([French and Poterba, 1991](#)).

Home bias persists for several reasons, including information and familiarity advantages, costs of foreign investment, corporate governance and legal protections, tax and regulatory restrictions, and currency hedging costs. [Van Nieuwerburgh and Veldkamp \(2009\)](#) show that, even in the presence of equal access to global information, home bias can result because investors endogenously choose which markets they should specialize in to gather information. Behavioral explanations like familiarity ([Huberman, 2001](#)), culture ([Grinblatt and Keloharju, 2001](#)) and patriotism ([Morse and Shive, 2011](#)) can also partly explain home bias. Despite these frictions, the modern ease of indexing to global benchmarks has made large home biases harder to justify on theoretical grounds.

Institutional asset allocation practice often segments the equity universe into distinct classes. The most common is splitting equity investments between domestic (the home bias) and international equities. The US is often treated as a stand-alone allocation given the importance of its market and the preference of institutional investors for large, liquid stocks with good governance ([Ferreira and Matos, 2008](#)). Institutional investors also frequently carve out emerging

markets (EM) as a stand-alone allocation rather than treating them as a component of a broad global index, which can be justified by the higher volatility and lower correlation of EM with developed markets (DM) (Bekaert and Harvey, 2012). Recently there has been movement to treat China as a stand-alone allocation within EM, or to invest in EM without China, because of its dominance in the EM universe and concern about potential risks of decoupling or uninvestability.

Equity factor premiums

Beginning in the 1980s, academics started to document that equity returns are systematically related to firm characteristics beyond market beta, leading to the documentation of equity factor risk premiums (also called style factors). The seminal work of Fama and French (1993) developed factors for small stocks and value stocks (stocks with high book-to-market ratios) in addition to the market factor. Their paper summarized earlier work that small stocks and value stocks have higher average returns than predicted by the one-factor market portfolio in the Capital Asset Pricing Model (CAPM). Value and size factors have become so ubiquitous that they are often treated as distinct suballocations and benchmarks in equity portfolios, which can be traced back to the introduction of the Morningstar Style Box in 1992.

Three other style factors have received substantial empirical and institutional support: momentum, low volatility, and quality. Momentum was documented by Jegadeesh and Titman (1993) and captures the tendency of stocks with strong recent performance to continue to outperform over intermediate horizons. Low volatility (or low risk) strategies exploit the empirical finding that stocks with lower return volatility have higher reward-to-risk ratios than high volatility stocks (Ang et al., 2006; Frazzini and Pedersen, 2014). Quality factors capture the out-performance of firms with strong profitability, stable earnings, fewer accruals, and conservative balance sheets (Sloan, 1996). These factors show that equity risk has several distinct dimensions, and that expected returns reflect exposure to different sources of systematic risk rather than market beta alone (see Ang, 2014, for a comprehensive review). The recent five-factor model of Fama and French (2015) is yet another example, where factors capturing profitability and investments are added to the market, size, and value factors (see also the work on gross profitability by Novy-Marx, 2013, the work on asset growth by Cooper, Gulen, and Schill, 2008, and the four-factor model of Hou, Xue, and Zhang, 2015).

From the perspective of pension funds, equity factor investing offers a way to tilt portfolios toward specific compensated risks while maintaining broad diversification. When implemented in long-short form, so that a large part of the market component is removed, factor strategies resemble some sources of return traditionally accessed through hedge funds (Fung and Hsieh, 2004). However, factor premiums are time-varying, just like the overall equity market, and

can experience extended periods of underperformance (see, for example, [Hodges et al., 2017](#)), just like the equity premium itself. As a result, factor investing is not a substitute for broad equity exposure for pension funds but can be regarded as a systematic refinement within a long-horizon asset-liability framework.

4.2.2 Fixed income

Fixed income securities play a central role in pension fund portfolios because they offer diversification and are the primary instruments for hedging liability-driven risks rather than for generating long-run growth. Pension liabilities are long-dated, interest-rate sensitive, and often linked to inflation, making bonds the natural building blocks for matching cash flows and managing duration on the liability side of the balance sheet.

There are two main components of sovereign fixed income securities—the short-term risk-free rate and the term premium. The term premium is the extra reward for holding a long-term government bond to its maturity above the risk-free rate. The left part of Exhibit 4.5 illustrates that the nominal yield can be decomposed into a nominal short rate and a nominal term premium.

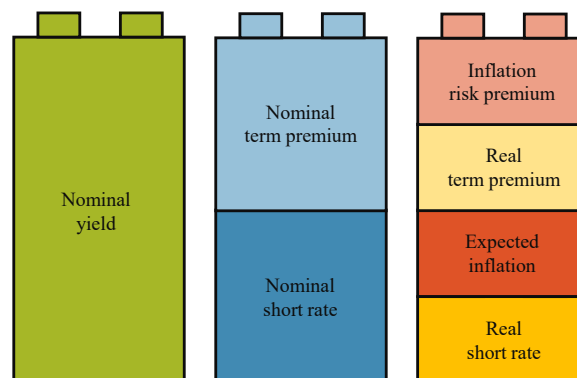


Exhibit 4.5: Decomposition of a yield on a long-term bond into short rate and term premium components. Both the nominal short rate and term premium can be further decomposed into real and inflation-related components.

The risk-free rate can further be decomposed into a real rate and inflation components. The latter constitutes expected inflation plus inflation risk. The right part of Exhibit 4.5 illustrates this. According to economic models, the real rate is determined by demographic factors, productivity growth, and the global balance of savings and investments (see, for example, [Holston, Laubach, and Williams, 2017](#)). The short-term risk-free rate is typically anchored by central bank policy, where central banks decrease target rates when economic growth is sluggish to stimulate the economy and raise interest rates during economic expansion if inflation accelerates (a so-called Taylor rule stemming from [Taylor, 1993](#)).

The term premium represents compensation for exposure to interest rate uncertainty over the

life of the bond. From a macroeconomic perspective, the term premium reflects the market's requirement for bearing inflation shocks, uncertainty about economic growth, and unexpected shifts in monetary policy (see, for example, [Ang and Piazzesi, 2003](#)). The term spread (the difference between long-maturity bond yields and the risk-free rate) typically rises during periods of high inflation uncertainty or when the diversification benefit of bonds—their tendency to hedge against growth shocks—diminishes. Historically, the term spread has turned negative before or during economic slowdowns ([Harvey, 1988](#); [Harvey, 1989](#); [Estrella and Hardouvelis, 1991](#), and more recently [Chinn and Ferrera, 2024](#)). Exhibit 4.6 further illustrates the decomposition of nominal yields into 1) average real short rate, 2) average inflation rate, 3) real term premium and 4) inflation risk premium using methodology from [García and Werner \(2010\)](#) on euro area bonds.

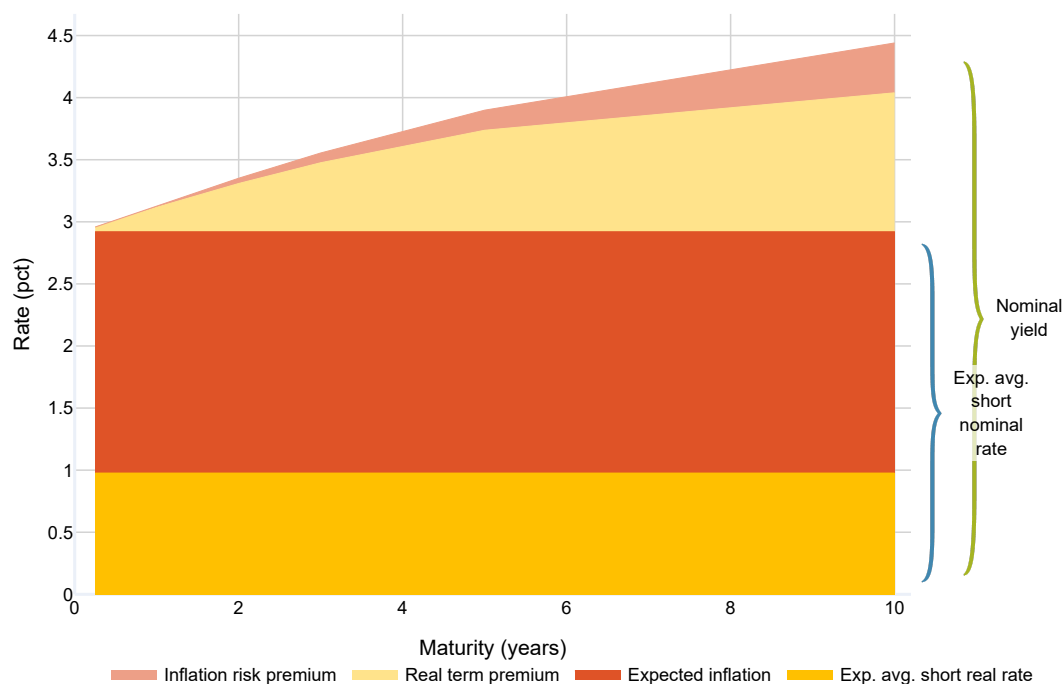


Exhibit 4.6: Decomposition of the term structure of interest into 1) average real short rate, 2) average inflation rate, 3) real term premium and 4) inflation risk premium. The exhibit is based on parameter estimates and a calibration to the average nominal yield and break-even inflation in [García and Werner \(2010\)](#).

Like equity returns, bond returns are partly predictable with short rates, term premiums, and inflation risk premiums all varying systematically over time (see, for example, [Gürkaynak and Wright, 2012](#)). For pension funds, the time-varying term spread has several effects. First, fixed income is a volatile source of return and because of convexity, bond prices decrease more sharply when interest rates rise from low levels than what they increase when interest rates fall from high levels. Second, significant shifts in the shape of the yield curve also affect the discounting of liabilities. While long-maturity bonds are appropriate for matching the long

duration of a pension fund's liabilities, significant shifts in the yield curve can lead to substantial mark-to-market volatility in the value of the fixed income portfolio and volatility of the funding ratio. Third, even a fully duration-matched portfolio (see Section 4.1) experiences mark-to-market volatility from non-parallel yield-curve shifts that are imperfectly correlated with the liability discount curve, particularly when inflation or growth surprises drive curve repricing rather than parallel short-rate moves.

Inflation-linked bonds

Several sovereigns in developed markets issue inflation-linked bonds (or real bonds), which provide direct protection against unexpected inflation by indexing principal or coupon payments to a price level. This makes inflation-linked bonds the closest match for real pension liabilities. For pension funds with inflation-indexed benefits, real bonds offer the best hedge against inflation risk that nominal bonds cannot provide, even when inflation expectations are embedded in nominal yields. However, markets for long-dated inflation-linked bonds are relatively thin, and real yields are also volatile due to fluctuations in real interest rates and inflation risk premiums (Ang, Bekaert, and Wei, 2008). As a result, while real bonds are highly effective liability-hedging instruments, their scarcity and duration limitations often require pension funds to supplement them with nominal bonds, derivatives like swaps and futures, or other inflation-sensitive assets as discussed in Section 4.1.5.

Corporate bonds

Bonds issued by companies are exposed to the same underlying risk-free rate and term structure dynamics as sovereign bonds, but they are also exposed to default risk, liquidity risk, and conditions on intermediary balance sheets. Credit spreads—the yield difference between corporate bonds and duration-matched government bonds—are often interpreted as compensation for expected default losses and systematic credit risk. However, a large empirical literature shows that expected default losses explain only a fraction of observed spreads, particularly for investment-grade bonds (Collin-Dufresne, Goldstein, and Martin, 2001). Instead, most changes in credit spreads are driven by non-default factors—like liquidity and time-varying volatility—rather than by firm-specific changes in default probabilities (Bao, Pan, and Wang, 2011).

There is a second important stylized fact in corporate bond returns—expected returns in corporate credit are not increasing in default risk. Instead, securities with lower default risk earn anomalously high risk-adjusted returns, and conversely bonds with high default risk earn relatively low risk-adjusted returns (Campbell, Hilscher, and Szilagyi, 2008). Thus, high-yield bonds behave more like equity substitutes but have lower Sharpe ratios. While several authors also document that some of the same style factor premiums in equities—like value, quality,

and momentum—are also observed in corporate bond markets (Israel, Palhares, and Richardson, 2018), the evidence has recently come into question (Dickerson, Mueller, and Robotti, 2023). Nevertheless, for pension funds, these findings imply that corporate bonds, particularly investment-grade credit, should be viewed as return-enhancing complements to sovereign fixed income rather than as pure liability-hedging instruments.

A large component of the systematic variation in corporate bond returns reflects exposure to the equity market. The drivers of credit returns—default rates, recovery rates, credit market conditions, and the financing conditions facing leveraged firms—respond to the same macroeconomic forces that drive equities and vary over the business cycle. Israel, Palhares, and Richardson (2018) and Bai, Bali, and Wen (2019), among others, decompose credit excess returns into a duration-matched government-bond leg, an equity beta component, and a residual credit premium, and find that the equity component accounts for the bulk of the systematic risk and return. For high-yield bonds, the credit premium component of returns is very small relative to the equity component. This means that pension funds should model corporate bond allocations considering their overall equity exposure.

Mortgage bonds

*Another important category for institutional investors is mortgage bonds, which embed prepayment and option risk.*¹² This means that when interest rates fall, prepayments accelerate and principal is returned to the investor at the time when re-investment rates in fixed income are low. When interest rates rise, duration extends and losses are magnified. Investors require a mortgage risk premium (or more specifically a prepayment premium) to bear this risk (Stanton, 1995). Giesecke et al. (2014) show that time-varying mortgage bond premiums are linked to intermediary balance-sheet constraints and limits to arbitrage more than to expected cash flows. For pension funds, mortgage bonds can offer incremental yield over Treasuries, but their negative convexity and procyclical behavior make them less effective for hedging liabilities.

Interest rate and inflation swaps

Interest rate and inflation swaps extend the hedging toolkit beyond cash bonds, as discussed in Section 4.1.5. A receiver interest rate swap (receiving fixed and paying floating) adds duration to a portfolio in much the same way as a long-term bond, but without requiring an outright bond purchase. This is particularly useful for a pension fund when the supply of long-dated bonds is insufficient to match the duration of liabilities, or when the fund wants to adjust duration without restructuring its bond portfolio. Inflation swaps serve a similar role for real liabilities: by receiving realized inflation and paying a fixed rate, a pension fund can hedge its

¹²For the Danish bond market, see Berg, Nielsen, and Vickery (2018).

inflation exposure even when the market for inflation-linked bonds is thin. In practice, pension funds often use a combination of bonds and swap overlays. The bond portfolio provides base cash flows and returns, while swaps fine-tune the duration and inflation profile to match the liability structure. However, swaps introduce counterparty risk and require collateral management, which adds operational complexity and can create liquidity demands.

4.3 Illiquid assets (or private market investments)

Key message

This section discusses private market investments, which have become an increasingly important component of institutional portfolios, but whose illiquidity, opacity, and cost structure require careful consideration within an asset liability management framework. The growth in allocations to private equity, private debt, real estate, and infrastructure reflects a search for higher returns and diversification beyond public markets. The evidence on risk-adjusted performance is mixed: while some studies find positive alpha for private equity buyout funds, others find neutral or negative risk-adjusted returns after properly accounting for leverage, risk exposures, and fees. Performance dispersion across managers is large, making manager selection critical, yet the ability to identify and access top-performing managers ex ante remains uncertain. For pension funds, private market investments are primarily a return-seeking allocation and belong to the speculative portfolio rather than the hedging portfolio. Moreover, smoothed valuations of private assets may create an artificially stable picture of the funding ratio, potentially understating the true risk on the balance sheet. As a result, pension funds must weigh the potential for higher long-run returns against the governance demands, cost burden, lock-up constraints, and measurement challenges that private market investments entail.

Pension funds allocate substantial capital to illiquid assets, like private equity and private debt, in search of higher returns, diversification, or access to return premiums not readily available in public markets. [Pew Charitable Trusts \(2025\)](#) report that public pension allocations to alternatives in the US grew from 18 pct in 2009 to 35 pct in 2022. [Døskeland and Strömberg \(2018\)](#) and [Døskeland and Strömberg \(2023\)](#) report that private equity fundraising and deals as a proportion of public equity markets have grown by approximately 0.2 pct of stock market capitalization every decade since the 1980s, and McKinsey estimates the total size of the private asset market at USD 13.1 trillion in 2023.¹³

Private market investments differ fundamentally from liquid assets in their governance, cost

¹³See [McKinsey & Company \(2024\)](#).

structure, liquidity, and valuation, and therefore raise distinct asset liability management considerations. We review the main forms of illiquid assets, how pension funds can access them, and the evidence on their role and performance in institutional portfolios.

4.3.1 What are private market investments?

Private market investments encompass asset classes that are not publicly traded and includes both private equity (PE) and private debt (PD). It is common to further decompose PE into venture capital (VC, early-stage, high-growth startups), growth equity (later-stage private companies seeking expansion capital), buyouts (leveraged acquisitions of mature private firms) and distress (turnaround cases of troubled companies). PD is further categorized into direct lending (non-bank loans to middle-market companies), distressed debt (buying debt of troubled companies), and mezzanine financing (hybrid of debt and equity financing). There are also private real assets (beyond traditional property) such as energy assets, mineral rights, farmland, and water rights. A major category of private real assets is infrastructure, which includes long-lived, capital-intensive assets such as transportation assets like airports, utilities, communication networks, and traditional and renewable energy generation and installations. Real estate includes commercial real estate and residential real estate, with commercial real estate often being divided into offices, industrial, and retail.

4.3.2 How to invest in private markets

Institutional investors can access private markets through several structures—direct investments, private fund investments, and co-investments. While each has distinct advantages and challenges, a common element is that the asset owner typically delegates governance and operations of the private market assets to external managers.

The three main approaches to investment in private markets are:

1. **Direct investments:** Investing directly in a private company or asset.
2. **Private fund investments:** Investing in private funds, which pool investor money to buy stakes in private firms or their credits; fund of funds are portfolios of private funds.
3. **Co-investments:** Investing alongside a private fund in specific deals (usually as a minority investor). Often, private market managers offer co-investments to asset owners who have made commitments to the managers' private fund investments.

[Døskeland and Strömberg \(2018\)](#) provide an extensive analysis and make recommendations to the Norwegian Ministry of Finance regarding private equity investments for the Government Pension Fund Global (GPF). They discuss pros and cons for 1–3, arguing that:

1. **Direct investments** eliminate intermediary fees and give greater control over investment terms and timing, but require significant internal resources, expertise, and governance capability. Direct investments are often best for large institutional investors (such as sovereign wealth or pension funds) with strong in-house expertise.
2. **Private fund investments** give access to professional management, diversified exposure across companies, and established fund structures, but can come at high investment costs, limited control over investment decisions, and long lock-up periods. Moreover, fund-of-funds offer diversification across managers and strategies but add an extra layer of fees. These vehicles are best for investors without in-house expertise.
3. **Co-investments** avoid fund management fees and performance fees on the co-investment portion, offer greater transparency and discretion, but require the asset owner to have capabilities to evaluate deals quickly and monitor investments while still relying on fund managers for sourcing and execution. Co-investments are best for large, sophisticated institutions seeking to lower costs and gain more control.

In a follow-up assessment, [Døskeland and Strömberg \(2023\)](#) conclude that their recommendations stand.

Most private equity investments are made by funds set up as a limited partnership. The general partner (GP) is the manager of the fund. The GP makes investment decisions and manages portfolio companies, has unlimited liability, and typically contributes some capital to the fund. The limited partners (LPs) are investors (such as pension funds, endowments, family offices). They provide the bulk of the capital, have limited liability (only risk their committed capital), and a passive role: they cannot be involved in day-to-day management.

LPs commit a certain amount of capital up front, but the asset owner typically does not invest the funds with the GP immediately—instead, the GP calls capital from the LPs (issues drawdowns) over time as investments are identified. The fund typically identifies and makes investments over the first 5 years of the fund, which is when most capital calls occur. The fund's harvest period (the following 5–7 years) focuses on managing and exiting investments. All in all, the LPs are locked in for periods of 10 to 12 years or more. Recently, there has been a trend to extend these periods, as there have been more limited opportunities to exit portfolio companies through listing on exchanges (via initial public offerings, IPOs) or in merger & acquisitions (M&As), and GPs have launched continuation funds, where portfolio companies are rolled into new funds with new and existing LPs.¹⁴

The timing of capital calls and distributions in a closed-end fund gives rise to a characteristic

¹⁴See, for example, [McKinsey & Company \(2024\)](#).

pattern known as the J-curve. In the early years, the LP experiences negative net cash flows as capital is called, fees are charged, and few investments have matured. As the fund enters its harvest period and exits investments, distributions increase and cumulative returns turn positive, tracing out a J-shaped pattern. For pension funds, the J-curve requires careful pacing of commitments across vintage years so that distributions from maturing funds offset capital calls from newer ones.

One way to mitigate the J-curve is through secondary investments, where an investor buys an existing LP stake in a private fund from another investor (either directly or through dedicated secondary funds). Because the fund is already partially through its investment period, the buyer acquires a portfolio of known, partially mature assets. This shortens the time to distributions and reduces the blind-pool risk of a primary commitment. For the seller, the secondary market provides a liquidity option in an otherwise illiquid asset class. However, secondary pricing depends on market conditions: discounts to NAV can be wide during periods of stress and narrow or turn into premiums when demand is strong. The buyer also has limited ability to influence the GP or the fund terms and must rely on the existing governance structure. Secondaries are suited for investors seeking to build or rebalance private market exposure more quickly than the primary fund cycle allows.

An alternative to closed-end funds is the evergreen (or open-ended) fund structure, which has no fixed end date and continuously reinvests proceeds rather than returning capital to LPs. Evergreen structures are most common in real estate and infrastructure, where the underlying assets are long-lived and cash-generating, and less common in buyouts and venture capital, where the value creation model has a natural exit cycle. By keeping capital continuously invested, evergreen funds mitigate the J-curve and reduce cash drag, but at the cost of reduced exit discipline and potential redemption constraints during periods of market stress.

LPs pay management fees (typically 1.5–2.0 pct per year of committed or invested capital) to a management company that employs investment professionals. LPs also pay carried interest (typically 20 pct of fund profits after LPs have received their capital back plus a preferred return, often 8 pct, and with a catch-up phase for the GP). Estimates of total management and performance fees are in the range of 5–7 pct per year of invested assets (see, for example, [Phalippou and Gottschalg, 2009](#); [Metrick and Yasuda, 2010](#)). The high costs create opportunities for higher net returns by considerably reducing fees in negotiations ([Begenau and Siriwardane, 2024](#)) or via the direct investments and co-investments discussed above.

Exhibit 4.7 summarizes the main features of the investment structures discussed above. Panel (a) covers direct investments, fund investments, and co-investments, while Panel (b) covers continuation funds, secondary investments, and evergreen funds; each is characterized along

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dimensions including the J-curve profile, fees, control, diversification, liquidity, key risks, and the type of investor for which it is best suited. The exhibit makes clear that the choice among structures involves trade-offs between cost, control, diversification, and operational burden, and that the appropriate structure depends on the institution's scale, in-house expertise, and tolerance for illiquidity.

Exhibit 4.7: Pros and cons of main private market investment structures and other funds.

Panel (a): Main investment structures for private market investments

	Direct investments	Fund investments	Co-investments
Description	Investing directly in a private company or asset.	Investing in private equity or private debt funds that pool investor capital; fund-of-funds are portfolios of funds.	Investing alongside a fund in specific deals, usually as a minority investor.
J-curve	No J-curve; cash flows depend on the investment itself.	Full J-curve; capital calls precede distributions by several years.	Partial; co-investments are typically drawn in a single call but exit timing follows the fund.
Fees	No intermediary fees.	Management fees (1.5–2.0 pct per year) and carried interest (typically 20 pct); fund-of-funds add a second layer.	Typically, no management fees or carried interest on the co-invested portion.
Control	Full control over investment decisions and timing.	Limited; GP makes investment and exit decisions.	Partial; investor chooses whether to participate deal-by-deal but GP sources and leads.
Diversification	Concentrated unless the investor builds a large portfolio.	Diversification across companies within each fund.	Deal-by-deal; diversification depends on how many co-investments the investor accepts.
Transparency	Full; the investor owns and monitors the asset directly.	Limited; periodic reporting from GP, often with a lag.	High for the specific deal; limited influence on broader fund decisions.
Liquidity	Illiquid; exit timing is controlled by the investor but finding buyers can be difficult.	Illiquid; locked up for 10–12 years with limited secondary market options.	Illiquid; tied to the fund's exit timeline.

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Exhibit 4.7 (continued): Panel (a)

	Direct investments	Fund investments	Co-investments
Key risk	Concentration and operational burden on the investor.	High fees, limited control, and blind-pool risk in early vintages.	Adverse selection—GPs may offer less attractive deals as co-investments.
Best suited for	Large institutions with strong in-house expertise.	Investors without in-house private market capabilities.	Large, sophisticated institutions seeking to reduce costs while leveraging GP deal flow.

Panel (b): Other fund structures

	Continuation funds	Secondary investments	Evergreen funds
Description	GP rolls portfolio companies from a maturing fund into a new vehicle with new and existing LPs.	Investor buys an existing LP stake from another investor on the secondary market (either directly or through dedicated secondary funds).	Open-ended fund with no fixed end date; continuously reinvests proceeds.
J-curve	Partially mitigated; assets are already mature but the new fund restarts the fee and distribution cycle.	Shortened; buyer enters a partially mature portfolio closer to distributions.	Largely eliminated; capital is continuously invested.
Fees	New fee and carry terms are negotiated; can result in a second round of fees on the same assets.	Priced into the discount or premium to NAV.	Ongoing management fees; performance fees vary by structure.
Control	Existing LPs can choose to roll over or exit; new LPs accept GP's terms.	Limited; buyer inherits the existing GP and fund terms.	Limited; GP manages continuously with no fixed exit deadline.
Diversification	Typically concentrated in a small number of portfolio companies carried over from the original fund.	Depends on the acquired stake; can provide instant exposure to a diversified, seasoned portfolio.	Broad if the fund is large and diversified; narrower in sector- or region-specific vehicles.
Transparency	Moderate; existing LPs can evaluate the known portfolio but must assess the GP's rationale for continuation.	Moderate; buyer can see the existing portfolio but has limited influence on terms.	Varies; some structures offer periodic NAV reporting but redemption terms can be restrictive.

Exhibit 4.7 (continued): Panel (b)

	Continuation funds	Secondary investments	Evergreen funds
Liquidity	New lock-up period, though typically shorter than a primary fund.	More liquid than primary commitments; growing secondary market.	Nominally more liquid through redemption mechanisms, but redemptions may be gated or suspended in stress periods.
Key risk	Potential conflicts of interest—the GP is both seller and buyer, setting the valuation and terms.	Pricing risk; discounts and premiums fluctuate with market conditions.	Reduced exit discipline; underperforming assets may be held longer than in a closed-end structure.
Best suited for	LPs who want continued exposure to strong-performing assets under a known GP.	Investors seeking faster deployment or portfolio rebalancing without the full J-curve.	Long-horizon investors in asset classes with stable, long-lived cash flows (for example, real estate, infrastructure).

4.3.3 Why invest in private markets?

Common arguments for alternative investments are that they may offer higher returns, which is often referred to as an “illiquidity premium,” and/or diversification to traditional asset classes. The higher returns may come from higher betas and/or positive alphas relative to the traditional asset classes (for example, traditional liquid assets do not span the returns of non-traditional illiquid assets). In particular, the higher betas of private equity investments can be due both to the leverage taken by those funds as well as the cyclical and higher betas of the portfolio companies in those funds (see [Korteweg, 2019](#), for a literature review). The general finding is that private market returns are not perfectly correlated with public market returns.

A common belief is that locking in assets for a long period gives a reward in terms of an illiquidity premium, and the alpha in private market investments may in part capture a premium for illiquidity. Unlike the findings on non-unity betas and the presence of significant idiosyncratic risk of private market investments, there are different conclusions on the existence of alpha and the illiquidity premium, which we discuss below. A more cynical view is to see the smoothed valuation in private markets as an advantage, leading to a willingness to accept a lower return on private assets.¹⁵

The analysis of [Døskeland and Strömberg \(2018\)](#) suggests that private equity has an overweight to growth industries (such as technology and healthcare) and certain geographies (such as China and India). That is, private equity may give exposure and diversification that public

¹⁵This is colorfully labeled “volatility laundering” by [Asness \(2023\)](#). See the discussion below.

markets cannot. In this sense, public asset returns do not perfectly span private equity returns. Relatedly, they argue that access to private equity has become more important for portfolio diversification over time.

Taken together, private assets are predominantly viewed as a return-seeking (speculative) allocation, complementing the public assets, rather than a liability-hedging one.

4.3.4 Performance of private assets

Assessing private asset performance is complex due to data limitations, illiquidity, and valuation challenges. The common performance metrics—such as IRR (internal rate of return), MOIC (multiple on invested capital), or TVPI (total value to paid-in capital), and PME (public market equivalent)—are unfortunately not returns and can sometimes be misleading. Not surprisingly, there have been different conclusions on risk-adjusted performance of private assets, and the topic continues to be heavily debated among academics and practitioners. The smoothing of NAVs artificially reduces measured volatility and correlations, making private assets appear more attractive than they are. The smoothed valuations of private assets can also create a misleading picture of the funding ratio's stability. When private assets are marked to model rather than market, the funding ratio may appear less volatile than it truly is, which has implications for regulatory capital discussed in Section 4.1.7.

Reported volatilities and correlations for private assets are systematically understated because appraisal-based valuations smooth out the high-frequency movements that show up in mark-to-market liquid, public returns. The mechanism, formalized by [Geltner \(1991\)](#) and [Geltner \(1993\)](#), with a summary in [Ang \(2014\)](#), is that an appraised value is constructed as a weighted average of the current period's true market value and lagged appraised values, so the reported return is a smoothed version of the true underlying data generating process. This makes private asset reported returns less volatile than the true returns and also causes reported returns to be highly positively autocorrelated. The reduction of measured return variance is roughly a factor of one-half to two-thirds ([Brown, Ghysels, and Gredil, 2023](#); [Couts, Gonçalves, and Rossi, 2024](#)). Another consequence is that betas to public market factors are biased downwards, so portfolio Sharpe ratios computed from reported NAVs overstate true risk-adjusted performance and reported correlations between private and public assets are too low ([Ang et al., 2018](#); [Stafford, 2021](#)). Reported private market volatility is therefore best interpreted as a lower bound on economic risk, and risk-adjusted performance comparisons should adjust for smoothing wherever possible. The most common performance measures, which we discuss below, do not adjust for risk along these lines.

Data and performance metrics

*Most of the empirical evidence is for returns on private equity investments.*¹⁶ Compared to public equity returns, there are many data and measurement challenges. When it comes to data, there are issues related to reliability and coverage of databases. Specifically, relative to public markets, there are fewer observations (often fund-level rather than deal-level data) and short time series for a young and maturing industry. Representative VC return data are particularly difficult to obtain. The data provider Burgiss is broadly considered to have the best coverage of funds with complete cash flow information. When it comes to measurement, private equity investments have different maturities, switching signs of cash flows, and the commitments are gradually invested. Moreover, private assets cannot be marked to market easily, and estimating their values is difficult. Hence, NAV estimates of unrealized investments tend to be too smooth and are potentially too optimistic.

The industry focuses on two main metrics to measure performance: (1) IRR, annualized and after fees and (2) received versus invested capital metrics of MOIC or TVPI before or after fees. Both MOIC and TVPI metrics are absolute measures and are not adjusted for market risks. Moreover, the MOIC and TVPI do not account for the timing of cash flows. The IRR is adjusted for the timing of cash flows but sensitive to the sequencing of cash flows (and thereby sensitive to gaming, see [Phalippou, 2008](#)).

The preferred, and dominant, metric in academia is the public market equivalent (PME), introduced by [Kaplan and Schoar \(2005\)](#). The PME compares the performance of a private equity or venture capital fund against a public market benchmark, like the S&P 500 index. It determines if a private investment has generated a better return than if the same capital had been invested passively in the public market, by modeling how the fund's cash flows would have performed over the same period. A PME greater than 1.0 indicates outperformance of the private market investment, while a value less than 1.0 suggests underperformance compared to the public market index. A refinement of the PME approach is direct alpha, which measures the annualized excess return of a private investment relative to a public market index.¹⁷ See [Korteweg and Sørensen \(2025\)](#) for a discussion of the various performance measures.

Performance of private equity

Academic studies suggest that US private equity funds overall have had PMEs greater than 1.0 relative to S&P 500 for vintage years from the early- or mid-1980s. [Harris, Jenkinson,](#)

¹⁶To name but a few studies with varying conclusions on private market alphas, see [Harris, Jenkinson, and Kaplan \(2014\)](#) and [Brown, Lundblad, and Volckmann \(2025\)](#) who find, on average, positive alphas for private equity and [Gupta and Van Nieuwerburgh \(2021\)](#) and [Korteweg and Nagel \(2024\)](#) for negative alphas.

¹⁷Since returns are unobservable but cash flows are observable, some authors like [Korteweg and Sørensen \(2010\)](#) and [Ang et al. \(2018\)](#) use Bayesian methods to estimate the latent private market returns.

and Kaplan (2014) find that buyout fund performance consistently has exceeded that of public markets, and that VC funds outperformed public equities in the 1990s but underperformed in the 2000s. While there is outperformance relative to the S&P 500 index, it remains an open question whether this is due to greater (unmodeled) risks, leverage, and illiquidity of private equity funds. Korteweg (2019) and Ljungqvist (2024) discuss these issues and point to studies concluding that private equity investments have had a more neutral performance relative to public equities.

While the average performance may be better, or at least neutral, for private equity relative to public equity, there are large differences in performance between top and bottom quartile funds.

The large dispersion suggests that manager selection is critical. An interesting question is: do the well-performing GPs repeat? Since the foundational work of Kaplan and Schoar (2005), the literature has found evidence of persistence in private equity performance across funds raised by the same GP, particularly for VC funds (see Ljungqvist, 2024, for a review). However, buyout funds' performance persistence has become weaker over time, as Harris et al. (2023) and others document. Moreover, it is unclear how an investor can benefit from persistence as the previous fund performance is not known at the time of the fundraising (Phalippou, 2010; Korteweg and Sørensen, 2017). There is less evidence of persistence starting with investing in a previous second fund, and access to the best, most persistent fund managers can be limited.

Assessing VC performance is particularly challenging because returns are extremely skewed, infrequent, and subject to severe selection and valuation biases. Cochrane (2005) shows that while naïve estimates suggest very high average returns and alphas, correcting for endogenous selection into observed exits (you tend to communicate exits only of successful VC companies) dramatically lowers mean returns. The volatility of VC investments is extremely high and can easily exceed 100 pct. Overall, the performance of VC funds has been lower than PE (buy-out) funds (see Brown, Lundblad, and Volckmann, 2025). Many of the same stylized facts in PE performance generalize to VC performance—there is pronounced cyclicity and weak performance following large capital inflows (Harris, Jenkinson, and Kaplan, 2014). Studies like Korteweg and Sørensen (2010), Sensoy, Wang, and Weisbach (2014), and Harris et al. (2023) emphasize that VC performance is characterized by substantial dispersion and persistence at the fund level—stronger than in buyouts—and much of the apparent outperformance accrues to a small subset of top-tier managers to whom access is limited.

Performance of private debt

In contrast to the more established private equity industry, private debt is a new segment of private assets which has grown significantly in recent years (see, for example, Block et al., 2023, who survey US and European LPs as well as GPs on private debt assets). There is

much less evidence of its performance and persistence. In a recent study, [Erel, Flanagan, and Weisbach \(2025\)](#) find that a typical private debt fund has given an insignificant abnormal return to its investors. Notably, they document a positive and substantial alpha when the portfolio is treated as pure debt, but the alpha falls to zero once the equity exposure embedded in these portfolios is accounted for. Relatedly, [Ivashina \(2026\)](#) highlights the relation between private debt and private equity, since returns and valuations are often tied to the same underlying assets. For a review of the rise and risk in private debt, see Chapter 2 in [International Monetary Fund, 2024](#).

Performance of portfolio companies

A large literature shows that private equity ownership tends to improve firm performance. Private equity / buyout funded companies are associated with increases in productivity and profitability often with positive externalities for employees and customers ([Gompers and Kaplan, 2022](#)). Hence, PE investments seem to create value. [Kaplan and Strömberg \(2009\)](#) discuss the value creation in terms of financial engineering (high leverage with better incentives and capital structure), governance engineering (active boards, and recruit, replace, and incentivize management), and operational engineering (industrial networks, M&A skill, and in-house practices / support functions). [Strömberg and Thomann \(2026\)](#) embed these mechanisms in a broader framework in which the value created by active, informed and concentrated ownership is weighed against the costs of illiquidity and delegated portfolio management, so that in equilibrium only firms for which the benefits exceed these costs should end up under private equity ownership. An important question is who captures the value created? The evidence suggests that GPs, rather than LPs, capture most of the excess returns.

Performance of real estate

*The largest private asset class—real estate—constitutes over two-thirds of the global wealth portfolio and is the largest source of wealth for households.*¹⁸ Despite the size and history of the real estate market, data on real estate returns suffers from the same problems as data on private company investments, and there are similar problems of high transaction costs and agency.

While economic historians have tabulated the prices of real estate in major cities from the 1600s, academic studies of investable real estate returns start in the 1980s, with the creation of the National Council of Real Estate Investment Fiduciaries (NCREIF) database. NCREIF contains return information, computed using appraisals, on US properties held by insurance

¹⁸See [McKinsey & Company \(2021\)](#). [Ghent, Torous, and Valkanov \(2019\)](#) estimate commercial and residential real estate to be approximately 50 pct of AuM in the US in 2017, which also includes equities, corporate debt, and US Treasuries.

companies, pension funds, and endowments.¹⁹ Other studies look at the returns on publicly traded Real Estate Investment Trusts (REITs), which have common long-run trends with direct real estate returns, but the two can sometimes have significant short-run differences.²⁰ Using both REITs and direct real estate returns, the literature has found that real estate returns have relatively low correlations to equities and bonds, a fact emphasized by textbooks on real estate finance and investments.²¹

Long-run returns on real estate are comparable to equity returns according to several seminal studies. For example, [Jordà et al. \(2019\)](#) find that with almost 150 years of data, residential real estate has delivered high average real returns of 7 pct per year, which is slightly higher than real returns of equities, but with lower volatility. [Chambers, Spaenjers, and Steiner \(2021\)](#) find that with approximately 80 years of data, long-run real returns of commercial real estate held by Oxford and Cambridge colleges to be between 2.3 pct and 4.5 pct per year. Of course, there can be significant differences in returns across regions and time—even Manhattan real estate declined in real terms by 30 pct from 1899 to 1999 ([Wheaton, Baranski, and Templeton, 2009](#)), and there were significant downturns in residential real estate prior to, during, and after the financial crisis ([Mian and Sufi, 2009](#)). Recently, commercial real estate prices declined steeply during COVID and have yet to recover ([Gupta, Mittal, and Van Nieuwerburgh, 2022](#)).

An important consideration in interpreting real estate performance is the use of leverage. Leverage is prevalent in most real estate funds due to the tangible nature of the collateral, and most institutional strategies utilize borrowing to amplify underlying returns. Consequently, performance measurements that do not explicitly adjust for leverage can be highly misleading. Many authors, including [Pagliari, Scherer, and Monopoli \(2005\)](#), emphasize that failure to adjust for leverage can substantially overstate real estate's risk-adjusted performance and distort comparisons with unlevered asset classes such as equities and fixed income, and distort comparisons with real estate benchmarks (NCREIF, for example, is unlevered and most REITs are levered). After accounting for leverage, [Bollinger and Pagliari \(2019\)](#) show that much of the historical outperformance of private real estate over REITs disappears.

There is generally weak academic evidence for consistent alpha in real estate investment. [Titman and Warga \(1986\)](#) provide early evidence and find no evidence of alpha; [Lin and Yung \(2004\)](#) also find no persistence. According to [Bond and Mitchell \(2010\)](#), who study UK commercial real estate funds, “very few managers appear to be able to generate excess risk-adjusted returns.” On the other hand, industry-sponsored research shows that active REIT portfolios

¹⁹For centuries-long studies of real estate see, for example, [Eichholtz, 1997](#). There are similar indexes to NCREIF for other countries, like the Investment Property Databank in the UK. Since NCREIF, there have been other real estate indexes, like the famous [Case and Shiller \(1987\)](#) real estate indexes and various commercial providers.

²⁰See [Pagliari, Scherer, and Monopoli \(2005\)](#) and [Ang, Nabar, and Wald \(2013\)](#).

²¹See, for example, [Hoesli and MacGregor \(2014\)](#) and [Brueggeman and Fisher \(2022\)](#).

have generated positive alpha (Beath and Barth, 2024). To the extent that excess returns exist above market REIT benchmarks or appraisal-based benchmarks like NCREIF, alpha in real estate may result from market conditions and cheap debt (Shilling and Wurtzebach, 2012) or by belonging to a strong network of managers (Yu, Liu, and Das, 2025).

Performance of infrastructure

The performance data on infrastructure investments are very limited. However, a significant fraction of large asset owners has some allocation to infrastructure; for example, Carlo et al. (2023) show that around half of the large funds in the CEM Benchmarking database in 2018 invest in infrastructure with an average allocation of around 5 pct. Evidence points to relatively low risk-adjusted returns for infrastructure assets. Andonov, Kräussl, and Rauh (2021) find that closed-end infrastructure funds exhibit negative risk-adjusted performance and, contrary to expectations of low risk and inflation-hedged returns, exhibit similar volatility as private equity investments and do not offer much diversification. Gupta and Van Nieuwerburgh (2021) find similarly poor risk-adjusted performance for both infrastructure and real estate private equity funds. In contrast, Brown, Lundblad, and Volckmann (2025) find that private infrastructure funds have added alpha relative to public infrastructure benchmarks, with the strong risk-adjusted performance helped by private infrastructure investments having significantly lower risk than public infrastructure returns.

4.4 Theory of investment management

Key message

This section develops the theory of investment management for the speculative portfolio, taking as given that the liabilities have already been hedged. We start from mean-variance theory, in which efficient portfolios are constructed through broad diversification across risky assets and across multiple sources of return premiums. In the speculative portfolio, investors should borrow or lend at the risk-free rate according to their risk tolerance and then invest in a mean-variance efficient portfolio that is exposed to compensated sources of risk, including global markets, style factors, illiquid assets, and sources of alpha. We will see that the latter should be included in a speculative portfolio only to the extent that they are expected to improve the portfolio's risk-return trade-off after accounting for implementation costs, capacity limits, and the residual risk of active bets. When investment opportunities are constant, the speculative portfolio should be rebalanced back to its target weights over time, so that the fund maintains the intended long-run risk-return trade-off.

After the liabilities are hedged, the remaining task is to construct and manage the return-seeking, or speculative, portfolio (called investment portfolio). This is done such that the speculative portfolio achieves the highest possible expected return consistent with the fund's risk tolerance, liquidity needs, and governance constraints. The starting point is modern portfolio theory, which shows that the efficient portfolio—the portfolio with the best risk-return trade-off—broadly diversifies across multiple sources of return. In dynamic extensions of this framework, investors should rebalance over time, and when investment opportunities vary, should also change their asset allocation. Once illiquidity, active management, and institutional constraints are introduced, the problem becomes richer, but the central insight remains: sound investment management begins with efficient broad diversification and then adjusts for the frictions and opportunities relevant to the investor.

4.4.1 Efficient portfolios and mean-variance investing

The starting point for the return-generating (or speculative) portfolio is mean-variance theory, which characterizes how investors can combine risky assets to obtain the highest expected return for a given level of risk. The central insight of modern portfolio theory since [Markowitz \(1952\)](#) is that efficient investing is a problem of diversification, while investor-specific considerations—like risk tolerance, liquidity needs, and institutional constraints—determine which efficient portfolio a given investor should choose.

Mean-variance frontier

The mean-variance frontier summarizes the best risk-return combinations available from risky assets and formalizes the core insight that diversification can improve portfolio efficiency. A portfolio is said to be efficient if it has the highest achievable expected return for a given level of risk, or equivalently the lowest achievable risk for a given expected return. The set of efficient portfolios formed from risky assets is summarized by the mean-variance frontier. [Exhibit 4.8](#) graphs the mean-variance frontier for stocks and bonds, which takes the shape of a leftwards-facing bullet using capital market assumptions (In this two-asset setting, the frontier represents all combinations of stocks and bonds totaling 100 pct). The more the frontier expands leftwards, the greater the expected return that can be achieved for a given level of risk. When the equity-bond correlation decreases, diversification benefits increase, and the mean-variance frontier further expands to the left.

Review of ATP's Investment Strategy

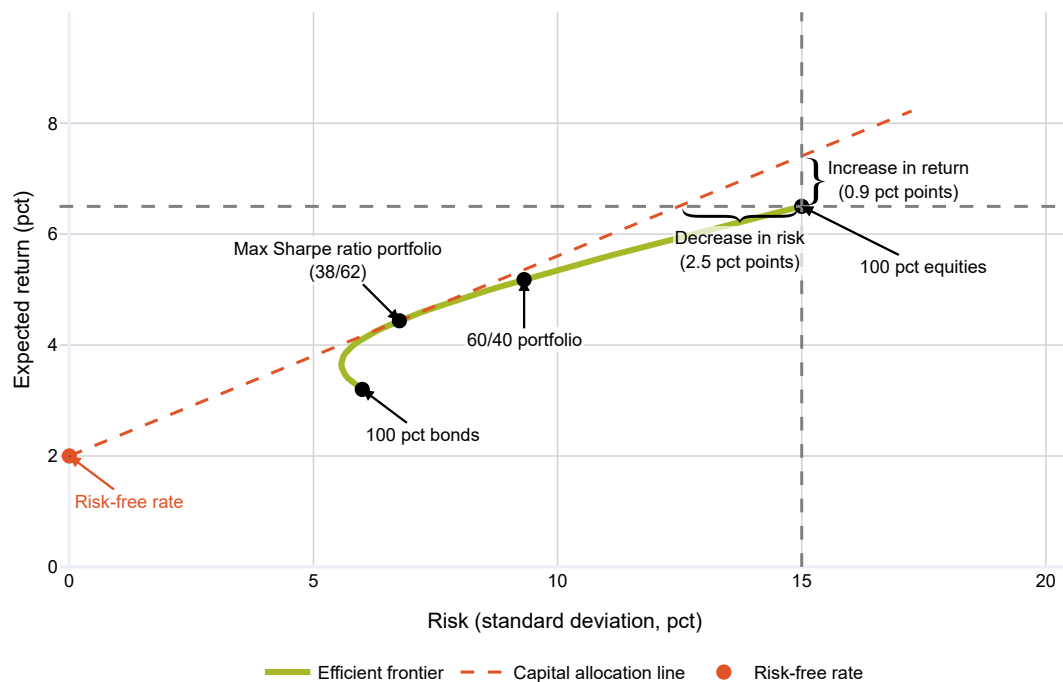


Exhibit 4.8: Mean-variance analysis for stocks and bonds. The capital markets assumptions are that the expected returns on bonds and equities are 3.2 pct and 6.5 pct, respectively; the standard deviations of bonds and equities are 6 pct and 15 pct, respectively; the correlation between bonds and equities is zero. With a risk-free rate of 2 pct, the Sharpe ratios of bonds and equities are 0.2 and 0.3, respectively.

Introducing a risk-free asset (in Exhibit 4.8 a known return of 2 pct), allows an investor to borrow or lend and pins down a unique optimal mix of risky assets. The set of efficient portfolios which have the greatest expected return per unit of risk is a line which is tangent to the mean-variance frontier. The line connecting the risk-free rate and the mean-variance efficient portfolio is referred to as the capital allocation line (CAL). In the exhibit, the tangency portfolio—also called the optimal speculative portfolio or mean-variance optimal portfolio—consists of 38 pct equity and 62 pct fixed income. Investors move along the CAL by borrowing or lending at the risk-free rate.

Being able to apply leverage on the tangency portfolio dominates concentrated equity holdings as a means of reaching high return targets. To see this, consider an investor targeting a volatility of 15 pct, the same level of risk as a 100 pct equity portfolio, shown as a vertical line in Exhibit 4.8. Rather than holding equities alone, the investor can instead leverage the 38/62 equity-bond tangency portfolio to the same 15 pct risk level. Because the tangency portfolio lies on the CAL, this leveraged position achieves a higher expected return—7.4 pct compared with 6.5 pct for the all-equity portfolio—at identical risk of 15 pct. The intuition is as follows: the tangency portfolio has a higher Sharpe ratio than equities alone, and leverage scales up both its return and its risk proportionally without altering that ratio.

When all investors optimize mean-variance efficiency, market equilibrium pins down a unique

risky portfolio that every investor should hold—the market portfolio. In this case, the tangency portfolio in Exhibit 4.8 becomes the market portfolio of risky assets and an investor mixes the market portfolio with a risk-free asset. In equilibrium, CAL is therefore referred to as the capital market line (CML). Risk-tolerant investors will leverage the market portfolio and risk-averse investors will hold a larger share of the risk-free asset, moving down the CML toward the risk-free rate. This result—that every investor holds the market portfolio, but in different proportions mixed with the risk-free rate—is called two-fund separation (see Tobin, 1958). This is the basis for the development of the Capital Asset Pricing Model (CAPM) of Sharpe (1964), Lintner (1965), and Mossin (1966).

The market portfolio is a natural starting point for any institutional investor constructing a speculative portfolio. First, in the CAPM, market prices adjust until supply equals demand, so the market portfolio reflects the aggregated information and beliefs of all market participants. An investor who deviates from the market portfolio must have superior information that the collective market does not. Second, the market portfolio obtains the highest risk-return trade-off so any deviation from it—without a specific informational advantage—moves the investor to an inferior risk-return trade-off. Third, the market portfolio can be implemented passively at low cost through market capitalization-weighted index funds. Fourth, the market portfolio provides broad diversification across sectors, geographies, and asset types, limiting concentration in any single source of risk. The market portfolio therefore serves as the natural starting point, or benchmark, for any institutional investor constructing a speculative portfolio.

Leverage

Exhibit 4.8 illustrates that reaching a higher point on the capital allocation line requires leveraging the tangency portfolio, raising the practical question of how this leverage is obtained. Institutional investors typically use three main channels—derivatives, repurchase agreements, and direct borrowing—each with different cost, collateral, and risk implications.

Derivatives (such as swaps, futures, and forwards) provide leverage implicitly through the small initial margin—cash or securities posted with the counterparty to back the position—required relative to the notional exposure. A pension fund can gain equity or bond exposure through index futures by posting margin equal to a fraction of the notional value, freeing up the remaining capital for other investments. Interest rate swaps and total return swaps similarly allow exposure to be obtained without an outright purchase of the underlying assets. Derivatives are typically the most capital-efficient and operationally flexible way to obtain leverage, and they are particularly useful for adjusting duration, factor exposures, or currency hedges around an existing portfolio. The main costs are transaction costs, tracking imperfections between the derivative and the underlying asset (basis risk), and the operational requirements of

posting and managing collateral as positions change in value. Counterparty risk, the risk that the other side of the contract fails to meet its obligations, is mitigated for exchange-traded futures through central clearing (a clearinghouse stands between the two parties and guarantees performance) and for over-the-counter swaps through bilateral exchange of collateral, though as the September 2022 UK LDI episode illustrated (see Section 4.1.6), large adverse market moves can generate sudden collateral demands that force procyclical asset sales.

Repurchase agreements (repos) allow an investor to obtain cash by selling securities (typically high-quality government bonds) with an agreement to repurchase them later at a slightly higher price, the difference reflecting the implicit financing rate. Economically, a repo is a collateralized loan: the investor retains the economic exposure to the underlying bond while borrowing cash against it, which can then be reinvested in other assets. Repos are widely used by pension funds, insurers, and hedge funds to leverage fixed income portfolios, particularly in liability-driven strategies where long-duration bond exposure is desired beyond what unencumbered capital allows. The main risks are rollover risk (repo financing is typically short term and must be renewed periodically) and the possibility that lenders demand more collateral, or withdraw financing altogether, during periods of market stress when funding liquidity tightens.

Direct borrowing, including issuing bonds or drawing on credit facilities, is a third channel for obtaining leverage. Some large institutional investors, such as sovereign wealth funds and certain pension funds, can issue debt directly in the capital markets, while others rely on bank credit lines for liquidity management. Direct borrowing provides longer-term financing than repos and avoids the basis risk associated with derivatives but is typically more expensive and introduces additional governance and balance-sheet considerations. For pension funds, direct borrowing is generally less common than derivatives or repos because of regulatory constraints, governance preferences, and the availability of cheaper synthetic leverage through derivative markets.

Together, these channels give institutional investors flexibility in how they implement the leverage required to reach the desired point on the capital allocation line. In practice, large pension funds and sovereign wealth funds combine all three: derivatives for tactical and strategic exposure adjustments, repos for financing fixed income positions, and occasional direct borrowing for liquidity or strategic purposes. The choice among them depends on the asset class involved, the desired term of the leverage, regulatory treatment, and the operational capacity to manage collateral and counterparty risk.

Moving beyond the market portfolio

After the invention of the CAPM, a large literature has shown that proxies of the market portfolio were inefficient and that investors should diversify across a broader set of rewarded risk premiums. Empirically, the market capitalization portfolio, in which each asset's weight is proportional to its total market value, does not have the highest risk-return trade-off and average returns of assets are not explained by market beta. As a result, for long-horizon institutional investors, a single cap-weighted domestic portfolio is no longer efficient.

The efficient portfolio should reflect the full set of compensated risks available to investors, rather than only the capitalization-weighted market portfolio. Empirically, the efficient portfolio incorporates risk premiums associated with international diversification, macroeconomic risks, style factors, and illiquid asset classes. [Adler and Dumas \(1983\)](#) show that once investors face multiple currencies and country-specific risks, the relevant benchmark becomes a global portfolio rather than a purely domestic portfolio. A large literature has documented that style factors (such as value, size, momentum, and carry) are also associated with persistent differences in expected returns across securities and portfolios (see [Ang, 2014](#), for a review). Finally, the efficient opportunity set extends beyond liquid public markets to include illiquid asset classes such as real estate and private equity (see Section 4.3). Thus, for a long-horizon institutional investor, the efficient portfolio is best viewed as a broadly diversified combination of rewarded exposures across asset classes, geographies, and factor risks, rather than the market portfolio.

Even after expanding the investment opportunity set to global markets, style factors, and illiquid assets, the basic logic of portfolio construction remains unchanged: the investor should first identify the efficient risky portfolio—now defined more broadly than a market capitalization portfolio in the CAPM—and then combine it with the risk-free asset. When higher risk is desired, this can be achieved more efficiently by leveraging the diversified efficient portfolio rather than by concentrating the portfolio in inherently riskier assets such as equities.

Macro factors

A complementary perspective views portfolio risk and returns through macroeconomic factors rather than style premiums. Following [Chen, Roll, and Ross \(1986\)](#) and [Cochrane \(2001\)](#), asset returns can be decomposed into exposures to a small number of macroeconomic drivers—most commonly growth, real rates, inflation, and credit—that span the risks priced into both equity and fixed-income markets. These macro factors are often not directly accessible and in practice are accessed through mimicking portfolios, which are combinations of assets constructed to have maximum correlations with each non-tradeable factor ([Lamont, 2001](#)). These macro

factor portfolios have delivered positive long-run excess returns. Macro factor models have also been applied to total portfolio construction, including portfolios with illiquid assets ([Bass, Gladstone, and Ang, 2017](#)). This framing is useful because asset classes often combine several macro exposures: public and private equities are exposed primarily to growth risk, nominal bonds to real-rate and inflation risk, inflation-linked bonds and commodities to inflation risk, and real estate and corporate bonds are a mix of growth, real rate, inflation, and credit risks.

4.4.2 Dynamic portfolio choice: rebalancing and intertemporal hedging

When investment opportunities are constant, the optimal dynamic policy is simply to rebalance the portfolio back to its static mean-variance efficient weights each period—horizon does not matter. In other words, although the mean-variance analysis of the previous section is static, the same efficient portfolio is constructed, and the investor rebalances back to that efficient portfolio each period. This benchmark setting with independent and identically distributed (IID) returns was studied by [Samuelson \(1969\)](#), [Merton \(1969\)](#), and [Merton \(1971\)](#) and is very powerful—it means the one-period, or myopic, efficient portfolio derived in Section 4.4.1 remains optimal period-by-period. But since prices change over time, the portfolio weights drift and the investor has to dynamically restore the portfolio's drifting weights to their target allocations. This process is called rebalancing.

Rebalancing

The process of rebalancing back to constant target weights is countercyclical—it buys assets which have fallen in price and sells assets which have experienced price increases. If equities underperform bonds, for example, their portfolio weight falls below target, and the investor restores the target allocation by buying equities and selling bonds. Conversely, if equities strongly outperform bonds, their portfolio weight rises above target and the investor trims equities and increases bond holdings. It is important to note that the motive for rebalancing is not a belief that short-term returns are predictable, but rather rebalancing back to target maintains the efficient long-run risk-return trade-off of the target portfolio. Without rebalancing, the portfolio drifts away from the efficient allocation and its risk characteristics can change substantially over time (see [Perold and Sharpe, 1988](#)). In the presence of time-varying expected returns, where expected returns increase when prices fall, rebalancing has an added benefit that it tends to buy risky assets when prices are low and expected returns are high.²²

Rebalancing can be implemented in several ways, and the simplest approach is calendar-based rebalancing where the portfolio is reset to target weights at regular intervals every month,

²²[Chien, Cole, and Lustig \(2012\)](#) argue that the failure of certain investors not to rebalance contributes to the countercyclicality of prices of risk.

*quarter, or year.*²³ Another common approach is threshold or band rebalancing, in which trading occurs only when portfolio weights deviate sufficiently far from their targets (see [Constantinides, 1986](#)). The latter approach is often preferred in practice because it balances the benefits of maintaining the desired risk exposure against transaction costs and market impact. In all cases, however, the economic logic is the same: rebalancing keeps the portfolio close to the efficient allocation implied by the investor's strategic policy.

The long-horizon advantage: intertemporal hedging demands

Once expected returns, volatilities, interest rates, or inflation vary over time, dynamic portfolio choice acquires an additional component making it optimal for an investor with a long-term horizon to hold a different portfolio from the one-period (or myopic) investor. The literature refers to this difference between the optimal long-horizon portfolio and the myopic portfolio as *intertemporal hedging demands*, following the terminology of [Merton \(1973\)](#). The intertemporal hedging demand allows the investor to hedge against future deteriorations in investment opportunities. For example, if expected equity returns fall when interest rates decline, a long-horizon investor should hold more long-duration bonds than the myopic portfolio would suggest—not because bonds are attractive in isolation, but because they pay off precisely when the investor's investment opportunity set worsens. The size and direction of hedging demands depend on the investor's horizon, risk aversion, and the specific state variables that drive changes in investment opportunities (see, for example, [Campbell and Viceira, 2002](#)).

When returns deviate from being IID, per-period volatilities are different at different investment horizons. In Section [4.1.5](#) we discussed what is considered a risk-free asset in the short and long term. In particular, Exhibit [4.3](#) illustrates why a long-term bond is less risky in the long term and that cash is risky for such a long-term investment. Similarly, when returns are not IID, there are risk-return trade-offs at different horizons (see the discussion in [Campbell and Viceira, 2005](#)). Specifically, when equities are mean-reverting due to time-varying expected returns, the returns are negatively correlated over time rather than being uncorrelated in the IID case, so the per-period long-term volatility is lower than the short-term volatility. Exhibit [4.9](#) illustrates that the annualized volatility for equity (in green) declines with the horizon when returns are negatively correlated. The exhibit also reinforces that a bond matching the horizon (here 20 years) has a high short-term volatility but no volatility for the exact horizon of 20 years, and that cash with no short-term volatility is indeed risky at longer horizons. Finally, the exhibit il-

²³See [Ang \(2014\)](#) for rebalancing schemes used in practice. [Harvey, Mazzoleni, and Melone \(2026\)](#) show that predictable rebalancing strategies, especially those implemented at fixed calendar intervals, can generate predictable price pressure and significant implementation costs because other market participants can anticipate and trade ahead of those flows.

illustrates that a constant-maturity bond has its lowest per-period volatility at medium horizons. The effects illustrated in Exhibit 4.9 are consistent with empirical evidence (see, among others, [Fama and French, 1988](#) and [Campbell and Viceira, 2005](#)) and generally supports the idea that for a long-term investor a long-term bond and equities are less risky than for a short-term investor. In the case of a long-term bond, this is because it better matches the horizon and for equities it is because it allows for more long-term recovery after an equity shock.

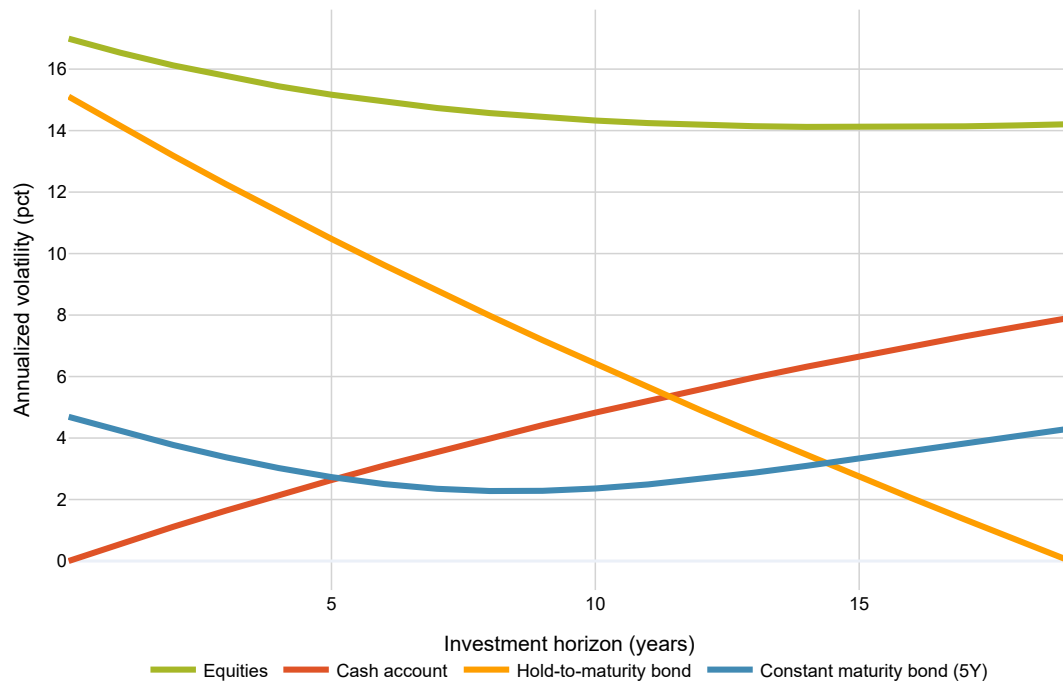


Exhibit 4.9: Volatility of returns for different investment horizons and asset classes.

For pension funds, intertemporal hedging demands are especially important because the liability side of the balance sheet is itself sensitive to the same state variables that govern changes in investment opportunities. One of the most important of these variables is the real interest rate. When real rates fall, the present value of pension liabilities rises, while expected returns on fixed income assets may also decline—a double adverse shock for the pension fund. A long-horizon pension fund should therefore hold more long-duration, inflation-linked bonds than a short-horizon investor would, not only to hedge liabilities directly, as discussed in Section 4.1, but also because these assets provide intertemporal insurance against the deterioration in the opportunity set associated with declining real rates ([Campbell, Chan, and Viceira, 2003](#)). More generally, the intertemporal CAPM of [Merton \(1973\)](#) implies that the speculative portfolio of a pension fund should be tilted toward assets that perform well when future investment opportunities deteriorate, giving long-horizon institutional investors a comparative advantage in bearing risks that short-horizon investors are less able or willing to hold.

Countercyclical versus procyclical investing

Countercyclical investment strategies buy as risky equity prices decrease; procyclical strategies sell as risky equity prices decrease. Since rebalancing is countercyclical, it is fundamentally different from the Constant Proportion Portfolio Insurance (CPPI) strategy discussed in Section 4.1.6 that protects liabilities: CPPI strategies sell as equities fall to protect liabilities. In this respect, rebalancing and CPPI have opposite trading implications. The tension between the two reflects a fundamental trade-off in pension fund investment management. Rebalancing optimally harvests the long-run diversification benefits of the speculative portfolio. (Note that the speculative portfolio is the portion of the portfolio invested *after* the liability floor is secured.) In contrast, CPPI seeks to protect the liabilities (solvency protection) by ensuring that asset values never fall below the liability floor. Countercyclical rebalancing does not guarantee that liabilities will be met. Although rebalancing may deliver higher long-run expected returns than a CPPI strategy, it also leaves a non-zero—and often significant—probability that asset values will not be enough to cover the liability floor. By contrast, CPPI sacrifices some upside in order to provide explicit downside protection for the liability floor.

4.4.3 Alpha and active risk

Alpha—the return earned in excess of systematic risk exposures—is theoretically possible but empirically scarce, capacity-constrained, and difficult to sustain, making it a complement to, rather than a substitute for, sound portfolio construction. The starting point is therefore the diversified passive portfolio described in the previous sections; active risk to pursue alpha is then introduced only to the extent that the investor has sufficiently strong information or skill to justify deviations from that benchmark. Note that the benchmark is usually set to comprise systematic, compensated risk—like the market portfolio, style factors, and macro risk premiums discussed in Section 4.4.1—which can be accessed passively and at low cost. Alpha, by contrast, is the residual return that an active manager earns after fully accounting for all systematic exposures.

Whether alpha exists, and if it exists whether it persists, has been one of the central debates in the finance literature. In the classical notion of efficient markets, Fama (1970) finds that alphas are equal to zero using information to predict returns using past returns (weak form efficiency) and all public information (semi-strong form efficiency).

The modern notion of efficient markets due to Grossman and Stiglitz (1980) does allow for the existence of non-zero alphas: Grossman-Stiglitz posit a “near efficient” economy with small pockets of inefficiency exploited by active managers with superior resources and skill. The actions of these active managers push prices towards an efficient equilibrium. Markets, on the

whole, are near-efficient so alpha is hard to find. More recent models by [Berk and Green \(2004\)](#) and [Berk and van Binsbergen \(2015\)](#), among others, show that skilled managers attract inflows, but alpha does not scale one-to-one with the increasing assets under management, causing alpha to be competed away. A large empirical literature on estimating alphas suggests that alphas in public markets are rare, non-persistent, and difficult to identify.

[Pedersen \(2015\)](#) and [Gârleanu and Pedersen \(2018\)](#) extend the Grossman-Stiglitz logic into a richer description of how active management actually works in practice, arguing that markets are “efficiently inefficient”: prices are inefficient enough to compensate skilled managers for the costs of gathering information, trading, and bearing risk, but not so inefficient that abnormal returns are easy to obtain. In this view, the size and persistence of alpha depend on the costs and frictions facing active managers—including funding constraints, search costs, leverage, and short-selling limits, and the risks of being forced to liquidate positions before mispricings correct. Investors who face fewer such frictions, or who have a comparative advantage in bearing the relevant risks, are best placed to earn alpha. [Gârleanu and Pedersen \(2018\)](#) make the delegation dimension explicit: since investors must search for informed managers and searching is costly, informed managers outperform after fees while uninformed managers underperform, and the returns to active management accrue to investors whose search and due diligence costs are small relative to the capital they deploy. For pension funds and other long-horizon institutional investors, this perspective suggests that the most reliable sources of alpha are those aligned with their structural advantages: long investment horizons that allow them to bear illiquidity and short-term mark-to-market risk, stable funding that reduces the likelihood of forced selling, scale that lowers transaction and access costs, and governance arrangements that allow them to act countercyclically when others are constrained. The implication is that alpha is not a generic skill to be sourced indiscriminately, but a return to specific comparative advantages, and the design of an active program should follow the institution's structural strengths rather than chase opportunities that better suit other investors.

Combining alpha and beta

[Treyner and Black \(1973\)](#) show how to optimally combine a passive benchmark portfolio with active alpha positions and derive a formula prescription for how much active risk an investor should take relative to a benchmark given the quality of their information. The key insight is that alpha is best thought of as an overlay on top of the efficient beta portfolio rather than a replacement of it. The investor holds the passive benchmark—the diversified portfolio of compensated systematic risks—and then tilts away from it in proportion to the strength and precision of their active views.

The size of the active overlay depends on the ratio of expected alpha to residual, or idiosyn-

*cratic, risk.*²⁴ Suppose the benchmark has a Sharpe ratio of $SR_b = E(r_b - r_f) / \sigma_b$, where r_b is the return on the benchmark, σ_b is the volatility of the benchmark, and r_f is the risk-free rate. The active strategy has an information ratio given by $IR_\alpha = E(r_\alpha - r_b) / \sigma_\alpha$, where r_α is the return of the active strategy in excess of the benchmark and σ_α is the idiosyncratic volatility of the active strategy. The Sharpe ratio of the portfolio holding an optimal combination of the active strategy and the benchmark is SR_p . The relationship between the Sharpe ratio of this optimal portfolio, the Sharpe ratio of the benchmark, and the information ratio of the active strategy is given by:

$$SR_p^2 = SR_b^2 + IR_\alpha^2.$$

This formula shows that the risk-return trade-off of the total portfolio improves only if the active manager can outperform the benchmark. The stronger the active manager's information ratio, the larger the improvement in the risk-return trade-off of the overall portfolio. Finally, note that the information ratio above is also referred to as an appraisal ratio.

In practice, the implementation of active overlays is bound by tracking error (TE) restrictions, which measure the extent to which the total portfolio deviates from the passive benchmark portfolio. Formally, the TE is defined as the standard deviation of the return difference between the active strategy and the benchmark. If the beta exposure of the active strategy is one to the benchmark, it coincides with the idiosyncratic volatility in the information ratio above. While TE is ubiquitous in active management, [Roll \(1992\)](#) presents a strong critique: unless the benchmark is itself mean-variance efficient, constraining tracking error forces the portfolio away from the true efficient frontier, replacing the investor's true objective—maximizing the Sharpe ratio—with the surrogate objective of staying close to an arbitrary benchmark. Other authors provide justifications for using TE: [Jorion \(2003\)](#) shows that when alpha is uncertain, tracking error constraints act as a form of shrinkage, pulling active bets back toward the benchmark and limiting the losses from poor active decisions; [Buffa, Vayanos, and Woolley \(2022\)](#) show that tracking error can be an effective governance tool preventing unskilled managers from taking excessive idiosyncratic risk at the expense of investors. Overall, while TE may be a second-best mechanism that is theoretically suboptimal relative to unconstrained mean-variance optimization, it is practically indispensable as a governance mechanism to control and monitor the agent's active bets.

From a mean-variance perspective, alpha creates value by expanding the efficient frontier outward (see Exhibit 4.10). If the active strategy has an information ratio of zero, then it adds no risk-adjusted return relative to the benchmark, and the mean-variance frontier is unchanged. In this case, allocating tracking error to the active strategy does not improve the investor's

²⁴[Ang et al. \(2021\)](#) develop a framework for combining index, factor, and alpha strategies in portfolio construction using priors on information ratios and explicit active-risk budgets.

Sharpe ratio. (Technically, the current investment opportunity set already spans the potential alpha strategy.) If the alpha strategy is additive and the information ratio is positive, the active strategy shifts the efficient frontier outward, allowing the investor to achieve a higher expected return for a given level of total risk, or equivalently the same expected return with less risk. The larger the information ratio, the greater this outward shift. In this sense, alpha is valuable not because it replaces the benchmark portfolio, but because it expands the investor's risk-return trade-off at the margin.

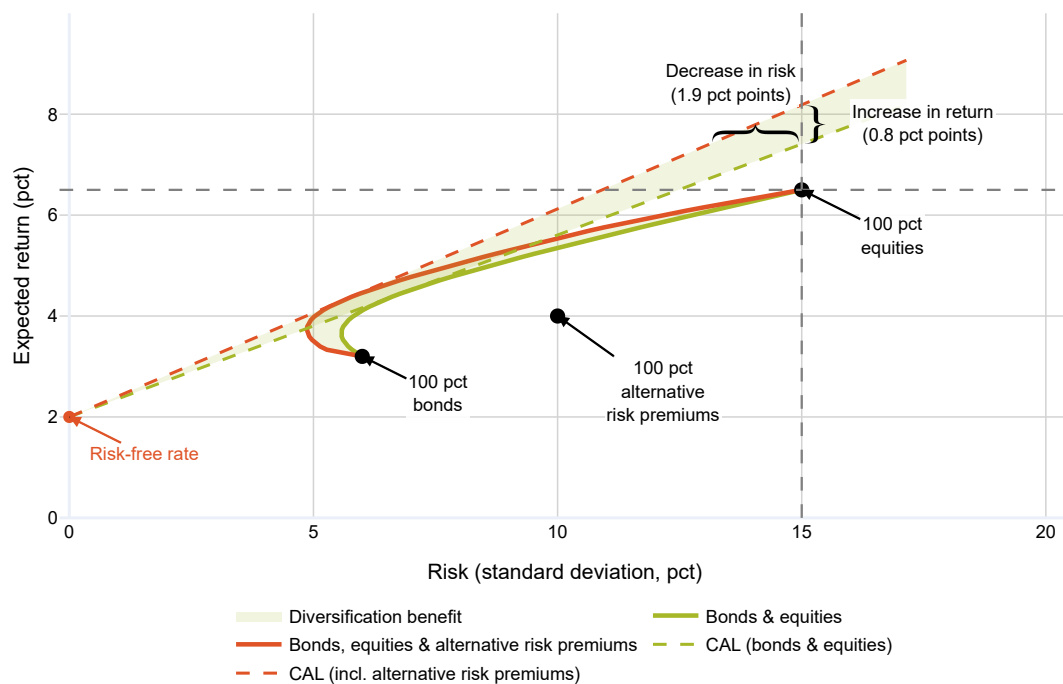


Exhibit 4.10: Impact on efficient frontier of adding an alpha strategy. The exhibit illustrates the impact of adding an alpha asset to the bond-equities efficient frontier. It is assumed that the alternative risk premiums strategy (for example, a hedge fund mandate) is uncorrelated with bonds and stocks and has an expected return of 4.0 pct and a standard deviation of 10 pct. The implied alpha and Sharpe ratios are then 2.0 pct and 0.2, respectively.

4.4.4 Illiquid assets and portfolio choice

Illiquid assets should play a role for large, long-term investors because private markets represent a material 5–10 pct share of the global investment opportunity set (Doeswijk, Lam, and Swinkels, 2014; Doeswijk, Lam, and Swinkels, 2020). However, developing a framework for integrating illiquid assets with liquid assets is non-trivial. Traditional mean–variance portfolio theory assumes that assets are perfectly liquid and can be traded costlessly at each instant—the addition of illiquid assets fundamentally alters optimal portfolio choice. However, relative to the models of asset allocation with liquid assets, there is a much smaller literature of asset allocation over illiquid assets. This reflects the technical difficulty of the problem: not being able to trade all assets continuously breaks the tractability of standard Merton (1969) and Merton

(1971) solutions and requires additional state variables to be tracked or modeled, like the proportion of illiquid to liquid assets, the shadow market value of illiquid assets, or the expected time to the next trading opportunity.²⁵

Ang, Papanikolaou, and Westerfield (2014) develop an asset allocation model with an illiquid asset which can only be traded at infrequent, random times. Illiquidity risk effectively increases risk aversion because the investor faces solvency risk—liquid wealth may be insufficient to fund consumption when there are large holdings of illiquid assets. A liquid asset optimally held at 60 pct in the frictionless Merton model falls to just 11 pct when rebalancing occurs, on average, once every five years. The model also delivers an illiquidity premium—equivalently, a shadow cost—defined as the excess return required to compensate investors for holding the illiquid asset. In the [Ang, Papanikolaou, and Westerfield \(2014\)](#) framework, the implied illiquidity premium can exceed 4 pct annually. [Jansen and Werker \(2022\)](#) compute shadow costs for investors with different spending (consumption) needs and tolerances for illiquidity. Shadow costs are highest for short-horizon investors and those facing substantial liquidity shocks that must be financed from liquid wealth. They estimate a much lower illiquidity premium of up to 0.55 pct for PE because long lock-up periods tend to restrict participation in PE to patient capital with limited near-term spending needs. Shadow costs are higher for less patient capital, reaching 0.26 to 0.85 pct for corporate bonds and up to 1.08 pct for illiquid stocks.

More institutionally realistic models of private equity recognize that limited partners make capital commitments that are drawn down stochastically by general partners (see Section 4.3.2). [Sørensen, Wang, and Yang \(2014\)](#) show that PE must earn an alpha of approximately 3 pct per annum net of fees to justify a meaningful allocation—below that level of alpha, the optimal PE weight falls sharply toward zero. [Dimmock, Wang, and Yang \(2024\)](#) model multiple illiquid assets with staggered lockup expirations and show that allocations are extremely sensitive to GP skill: increasing alpha from 0 pct to 3 pct raises the optimal alternatives allocation from zero to over 60 pct.

In the presence of infrequent trading, the fraction of the portfolio held in the illiquid asset can vary substantially, even when the holdings of illiquid assets are set optimally. In the [Ang, Papanikolaou, and Westerfield \(2014\)](#) model, if the optimal holding of illiquid assets is 20 pct when rebalancing can take place, the investor should expect the range of illiquid holdings to vary from 15 pct to 35 pct during non-rebalancing periods. [Dimmock, Wang, and Yang \(2024\)](#) show that during financial crises, PE holdings can deviate significantly from optimal targets by as much as 30 pct because illiquidity prevents timely rebalancing.

²⁵Related literature since [Constantinides \(1986\)](#) develops optimal trading strategies in the presence of transactions costs. These models capture one dimension of illiquidity—trading frictions—but do not address the main issue of illiquid assets like real estate, private equity, and infrastructure that cannot be traded at all for certain periods of time.

An alternative, and more engineering-oriented, approach is developed by [Luxenberg et al. \(2022\)](#) who formulate the illiquid asset's dynamics as a stochastic linear system. The investor's direct control variable is the size of new commitments in each period; positions then build up through stochastic capital calls and decline through distributions, neither of which the investor controls. They propose a model predictive control framework in which the investor re-optimizes the sequence of future commitments each period. The solution comes close to a benchmark in which the illiquid asset can be freely rebalanced.

The finance literature models illiquid assets in several other ways—illiquid durable goods (like automobiles), non-traded assets like labor income, housing, and restricted stock. Several takeaways emerge that are relevant to institutional investors. When consumption depends on an illiquid durable good, investors optimally reduce their holdings of risky financial assets relative to the fully liquid benchmark ([Grossman and Laroque, 1990](#)). [Heaton and Lucas \(2000\)](#) similarly show that entrepreneurs with concentrated, illiquid businesses optimally hold safer financial portfolios even when equity premiums are high. When investors hold illiquid leveraged assets, they may tilt their liquid investment portfolios towards equities to optimally diversify their illiquid housing exposure ([Flavin and Yamashita, 2002](#); [Yao and Zhang, 2005](#)). Finally, the required premium for holding illiquid assets increases with the duration of the illiquidity restriction. [Kahl, Liu, and Longstaff \(2003\)](#) consider the problem of an executive holding restricted stock and show that the illiquidity discount on the price of the restricted shares can often exceed 30 pct and rise with the restriction period.

4.5 Practice of investment management

Key message

This section discusses the practice of investment management for institutional investors. Efficient long-run portfolios take advantage of broad, factor-aware diversification and, when appropriate, use leverage to reach target levels of risk rather than over-allocating to equities. We discuss risk parity, which implements this idea by equalizing risk across assets—effective in normal regimes but vulnerable when stocks and bonds fall together. While strategic asset allocation is a long-run notion, it requires rebalancing in the short run to maintain diversification by resetting a drifting portfolio to long-run weights. Asset class allocations typically include assumptions for alpha, although we will see that alpha is scarce in liquid markets and often conflated with an illiquidity premium for illiquid assets like private equity and real estate. We close with governance—benchmarks, tracking-error budgets, and peer framing—which is a significant contributor to returns: poor governance can lead to excessive benchmark hugging or risk-taking.

With the theoretical foundations of asset-liability management, the characteristics of liquid and illiquid assets, and the theory of portfolio construction in place, we now turn to how institutional investors implement investment management in practice. The starting point is strategic asset allocation (SAA), which sets the long-term policy weights across asset classes. We then discuss risk parity as an alternative approach to portfolio construction and review how institutions allocate to illiquid assets in practice, including the endowment model and the total portfolio approach. We cover rebalancing, tactical asset allocation, and alpha opportunities. We close with governance and currency hedging.

4.5.1 Strategic asset allocation

Strategic asset allocation (SAA) determines the long-term policy weights across asset classes and is typically the single most important investment decision for an institutional investor. The strategic allocation sets target weights—for example, the proportions invested in equities, fixed income, private equity, real estate, and infrastructure—that reflect the fund's risk tolerance, liability structure, investment horizon, and governance capacity. These weights define what is often referred to as a normal, target, policy, or reference portfolio. This target SAA portfolio is typically set by a board, but it is generally worked out and proposed by the management team, especially the CIO. The SAA serves two purposes: it provides general guidance for the investment staff in day-to-day portfolio management, and it serves as the benchmark against which actual portfolio performance is evaluated ex post. Strategic allocations are typically for long investment horizons (typically five to ten years), though they are revisited and decided more frequently (typically, once a year). In a pension context, the strategic allocation is typically integrated into the regular asset liability management process (see Section 4.1.4). From a regulatory perspective, the strategic asset allocation is a key input to the own risk and solvency assessment (ORSA) under Solvency II (see Section 4.1.7), as the investment strategy directly affects the risk profile and capital needs that the ORSA must evaluate.

The starting point for a strategic asset allocation is a set of capital market assumptions (CMAs)—estimates of long-run expected returns, volatilities, and correlations for each asset class, combined with the characteristics of the liabilities in an ALM context. These assumptions are forward-looking and typically constructed by combining historical data with economic models, market-implied information, and judgment. There are many methods to estimate CMAs. For example, a forward-looking return on equities can be determined using purely historical averages; the equity premium can be adjusted for different macro regimes (Ang and Timmermann, 2012); inverted from market capitalization weights following Black and Litterman (1992); estimated in a “building block” approach that sums dividend yields, earnings growth, and valuation changes following Grinold and Kroner (2002); implied from

price-earnings ratios or other valuation ratios, especially using price-earnings ratios cyclically adjusted for inflation over long periods (Campbell and Shiller, 1988); or with other statistical or machine learning models.

Dahlquist and Ibert (2024) find that large asset managers' CMAs are countercyclical: they are high (low) when valuations are low (high), following economic theory and empirical evidence (see Section 4.2). They also find that asset managers tilt their portfolios toward equities when they have optimistic equity return expectations. Hence, asset managers seem to “put their money where their mouth is,” giving credibility to the CMAs. Taken together this suggests institutional allocations are, overall, countercyclical. Dahlquist and Ibert (2026) examine CMAs for a broader set of institutional investors, including pension funds. They find that most asset managers use the “building block” approach to form CMAs. They then show that there is substantial disagreement across institutions and tie the disagreement in equity return expectations to differences in views about long-term equity valuations.

The SAA portfolio is the industry counterpart of the theoretical mean-variance efficient portfolio (see Section 4.4.1). The mean-variance efficient portfolio harvests broad, well-diversified sources of return: the SAA portfolio typically does this by incorporating many or all of the asset classes discussed in Sections 4.2 and 4.3: US and regional allocations of equities, sovereign bonds, real bonds, corporate bonds, and mortgages, and illiquid asset classes like real estate and private equity. In practice, institutions often subdivide US equities into style or capitalization buckets such as value/growth and large/small cap, whereas international equity allocations are more commonly organized at a broader regional level, such as non-US developed, emerging markets, and global ex-US. A well-known challenge in constructing the SAA portfolio with mean-variance optimization is that the optimal allocation is highly sensitive to the CMAs.²⁶ In practice, many constraints are imposed on the mean-variance optimization to ensure that asset positions are not extreme.

Like the theoretical mean-variance efficient portfolio, the SAA is a benchmark concept rather than a short-term trading portfolio. The SAA is intended to be the long-run target allocation that best matches the investor's objectives and constraints, against which actual positions and active decisions are measured. This is why the SAA often serves simultaneously as the portfolio's policy anchor and its performance benchmark. Tactical asset allocation (TAA), discussed below in Section 4.5.6, by contrast, involves shorter-term deviations from the strategic weights in response to time-varying expected returns or volatility. Manager selection and other active deviations are also layered around the SAA benchmark.

²⁶See Best and Grauer (1991). Michaud (1989) calls mean-variance optimization “estimation error maximization.”

The traditional 60-40 equity-bond portfolio provides a useful and important reference point for comparing SAA portfolios because of its simplicity, transparency, and long history in institutional investing. In broad terms, the equity allocation is intended to generate long-run growth, while the bond allocation provides income and diversification. The 60-40 weights correspond approximately to the market capitalization weights of common global equity and bond indexes—at end of March 2026, the market capitalizations for MSCI ACWI for global equities and Bloomberg Global Agg are USD 89.8 trillion and USD 74.6 trillion, respectively, equivalent to an equity-bond mix of 55-45.²⁷ This also equates to an expected return of approximately 10 pct and a volatility of 10 pct, which seems to be an acceptable risk-reward trade-off for many investors.

4.5.2 Risk parity

Risk parity is a particular type of SAA approach that allocates risk, rather than capital, across asset classes. The central idea is that traditional strategic asset allocations such as a 60-40 equity-bond portfolio appear diversified in capital terms but are often highly concentrated in risk terms, because equities are much more volatile than bonds. As a result, most of the total portfolio risk in a conventional 60-40 portfolio is typically driven by the equity allocation. Risk parity, formally introduced by [Qian \(2005\)](#) and [Qian \(2011\)](#), addresses this imbalance by choosing portfolio weights so that each major asset class contributes approximately equally to overall portfolio volatility.

Allocating so that asset classes, or sources of returns, have equal risk causes risk parity strategies to hold larger capital weights in low volatility assets, like sovereign bonds, compared to 60-40 equity-bond portfolios. Section 4.4.1 shows that 60-40 portfolios do not have the highest risk-return trade-off (see Exhibit 4.8). The tangency mean-variance efficient portfolio holds a larger proportion of bonds than equities because bonds provide diversification benefits with lower volatility. Risk parity can thus be viewed as a practical implementation of the theoretical tangency portfolio. Risk parity strategies also have an advantage over traditional SAA approaches because no CMAs are required, and volatilities are estimated much more precisely than expected returns (see [Merton, 1980](#)).

Risk parity is also consistent with the theory of efficient portfolio construction in applying leverage—not equity concentration—to reach a target level of risk. After the efficient portfolio is constructed, which holds a relatively higher allocation to bonds, the risk parity strategy uses leverage to scale the balanced-risk portfolio along the capital allocation line (see Section 4.4.1

²⁷[Ilmanen \(2022\)](#) explores the origins of the canonical 60-40 portfolio and found its origins “unclear,” but does uncover the first reference to 60-40 in [Innocenti \(1969\)](#) in the *Financial Analysts Journal*, a leading investment practitioner publication.

and Exhibit 4.8). A 60-40 equity-bond portfolio has a risk of 9 pct, and 86 pct of the risk is due to equities. Through the risk lens, traditional 60-40 portfolios are dominated by equities because equity risk is 3–4 times greater than bond risk. The mean-variance efficient portfolio holds 23 pct in equities and 73 pct in bonds, and has a volatility of 4.9 pct. To reach the same volatility of 9 pct as the 60-40 portfolio requires a leverage of 1.8 times.

Historically, risk parity strategies have delivered higher risk-adjusted returns than traditional 60-40 portfolios, particularly in environments where bonds provide both diversification and attractive returns (see [Asness, Frazzini, and Pedersen, 2012](#)). However, their performance depends critically on the stock-bond correlation and on the behavior of interest rates. When equities and bonds perform well at different times, risk parity benefits from diversification; when both decline simultaneously, as in 2022, the approach can underperform more conventional portfolios. Risk parity should therefore not be understood as a free lunch, but as a disciplined approach to constructing balanced risk exposures across major asset classes. The approach has gained widespread institutional adoption: Bridgewater Associates pioneered the strategy in 1996 with its “All Weather” fund followed by AQR, BlackRock, Invesco, and other asset managers. Risk parity strategies reached USD 400 billion by the mid-2010s and one source estimates there was around USD 1 trillion in risk parity strategies before the COVID-19 crisis.

The weakness in risk parity strategies is when both equities and bonds experience large draw-downs together, as these are periods when diversification fails. This occurred in 2022, as we discuss in Chapter 7.

Macro factors

A number of institutions construct risk parity portfolios based on a macro factor framework. This reflects the academic literature, which views asset classes, and not just securities within asset classes, as having risk premiums that are linked to exposure to macro factors—especially growth and inflation (Section 4.4.1). Bridgewater’s All Weather Portfolio, in particular, which popularized risk parity strategies among institutional investors, constructs portfolios robust to growth and inflation risk ([Dalio, Prince, and Jensen, 2004](#)).²⁸ BlackRock, Invesco, PanAgora, PGIM, among others, also build risk parity portfolios incorporating macro factors with portfolios comprising a leveraged, risk-balanced combination of growth, inflation, and rate-sensitive exposures, designed to perform across macroeconomic regimes rather than directly building off market capitalization benchmarks. Using a factor lens in portfolio construction is actually broader than risk parity, and among the large institutional investors who have used factors to construct their non-risk parity portfolios are Canada Pension Plan and GIC.²⁹ Macro factors

²⁸See, respectively, [Fergis et al. \(2019\)](#), [Invesco \(2024\)](#), [Qian \(2005\)](#), [Qian \(2011\)](#), and [PGIM \(2024\)](#).

²⁹See, respectively, [CPP Investments \(2024\)](#) and [GIC \(2024\)](#).

are especially useful for modeling the risks of liquid and illiquid investments in a consistent framework so that they are exposed to common sources of macro risk (see [Gladstone et al., 2021](#)).

4.5.3 Industry allocations to illiquid assets

While the world market portfolio provides a theoretical starting point for thinking about allocations to illiquid assets, actual institutional allocations to illiquid assets vary widely across investor types. The appropriate allocation to private markets depends on the nature of liabilities, liquidity needs, governance capacity, internal investment capabilities, and the institution's comparative advantage in sourcing and managing illiquid investments. For a pension fund, the central issue is not simply whether private assets belong in the portfolio, but how much illiquidity can be borne without impairing rebalancing, benefit payments, or the ability to respond to market stress.

A useful benchmark is the investable world market portfolio comprising both liquid and illiquid assets. [Doeswijk, Lam, and Swinkels \(2014\)](#) and [Doeswijk, Lam, and Swinkels \(2020\)](#) estimate a broad world market portfolio and show that private markets constitute a meaningful, though not dominant, share of total investable wealth. Their updated work suggests that in 2023, private equity amounted to about USD 13.4 trillion (based on Preqin data, including both invested capital and undrawn committed capital), compared with public equity of USD 74.1 trillion and a world market portfolio of USD 172.4 trillion. Thus, in their estimates, private equity constitutes 15.4 pct of total equity and 7.8 pct of the world market portfolio. Note that the private market size is endogenous in the sense that more committed capital leads to a larger fraction of PE of the total market. A recent Goldman Sachs report by [Mueller-Glissmann et al. \(2025\)](#) is consistent with the main finding of [Doeswijk, Lam, and Swinkels \(2014\)](#) and [Doeswijk, Lam, and Swinkels \(2020\)](#)—that there should be large allocations to illiquid assets in a world market portfolio. [Mueller-Glissmann et al. \(2025\)](#) estimate that the world market portfolio is around USD 250 trillion. It consists of US equity (32 pct), non-US equity (18 pct), non-US bonds (21 pct), US bonds (16 pct), gold (6 pct), private markets (5 pct), real estate (2 pct), and crypto (1 pct). This suggests that the most recent developments in the world capital markets make private markets a smaller fraction of the total market.

While the CAPM and the world market portfolio are a reasonable starting point, the specifics for an institutional investor are important. For example, we have emphasized the liability side of a pension fund and the importance of a hedging portfolio, with the caveat that the explicit liabilities of a sovereign wealth fund or an endowment may be less well defined than for a pension fund with pension obligations. Nevertheless, the composition of the world market can give some guidance for the speculative portfolio.

At one extreme, Norway's Government Pension Fund Global invests almost exclusively in public markets. Its reference portfolio consists of 70 pct public equity and 30 pct public fixed income securities, but up to 7 pct can be invested in private real estate and up to 2 pct in private renewable energy infrastructure. At the other extreme, university endowments tend to have large allocations to private assets and other alternatives such as hedge funds (see below for the endowment model).

It is worth noting that most institutions used to allocate only to illiquid assets, especially real estate. At the turn of the 20th century, college endowments used to hold most of their endowments in real estate (see [Dunbabin, 1975](#))³⁰ and insurance companies used to be the dominant institutional investors in direct real estate ([Miles, Cole, and Guilkey, 1990](#)). Thus, endowments and insurance companies have always held “illiquid” investments but moved into liquid equity investments during the early 20th century.

A practical difficulty in investing in illiquid assets is that allocations to private assets are hard to manage dynamically. (Recall the discussion on rebalancing in Section 4.4.2.) Unlike public securities, private market exposures depend on the timing of commitments, capital calls, distributions, and valuations set partly by general partners. As a result, it is notoriously difficult to consistently hit a specific target investment in private assets. Dynamically reallocating private assets is even more difficult. There is some benefit of being countercyclical in private equity ([Døskeland and Strömberg, 2018](#); [Døskeland and Strömberg, 2023](#)). However, it is hard to be countercyclical due to procyclicality in fundraising and investment ([Brown et al., 2021](#)). More generally, being countercyclical requires flexible asset allocation mandates—are boards willing to increase allocations to risky assets when recent past returns have been poor? Potential ways to increase allocation when markets are stressed, and illiquidity premiums are high, include direct investments, opportunistic co-investments, and secondary transactions at deep discounts. This, of course, requires “dry powder.” Hence, in these times there could be a value transfer from less liquid to more liquid investors.

4.5.4 Endowment model

The endowment model is one of the most influential developments in institutional investment practice and is closely associated with David Swensen's management of the Yale endowment. Its defining feature is a substantial shift away from traditional public equity and fixed income allocations toward illiquid and alternative assets, including private equity, venture capital, real assets, and hedge funds. Swensen managed the endowment of Yale University from 1985 to his death in 2021. His book, *Pioneering Portfolio Management*, is regarded as an investment bible

³⁰John Maynard Keynes, the great economist, managed the King's College endowment, which he turned into a modern equity-focused, high active risk portfolio with style tilts (see [Chambers, Dimson, and Foo, 2015](#)).

for many US-based endowment funds and started the trend towards holding large weights in alternatives and illiquid asset classes in institutional portfolios.³¹ Swensen's thesis was that in liquid markets, competition leads to limited opportunities for outperformance, especially as managers often have limited horizons and face constraints on financing (see also [Shleifer and Vishny, 1997](#)). In this view, the endowment model moves beyond the theoretical mean-variance efficient portfolio (Section 4.4.1) and the SAA (Section 4.5.1)—the role of the endowment is not merely to hold a diversified market portfolio, but to actively exploit those parts of the investment opportunity set where patient capital and strong governance are most valuable.

The endowment model explicitly links high illiquid allocations to the prospect of superior long-run returns and holds large allocations (often above 50 pct) to illiquid assets like private equity, venture capital, real assets, and absolute return strategies. Conversely, the endowment model has significantly reduced allocations to public equities and fixed income. [Lerner, Schoar, and Wang \(2008\)](#) show that institutions with larger allocations to illiquid assets have historically earned higher returns than traditional 60-40 portfolios, but there is also high dispersion of performance across institutions. This dispersion is central to the model: success depends not only on holding more private assets per se, but on identifying and accessing top-performing managers (see [Harris, Jenkinson, and Kaplan, 2014](#)). Thus, the endowment model is as much a governance and manager-selection model as it is an asset-allocation model.

Consistent with Swensen's thesis, illiquid asset manager performance exhibits large dispersion and persistence—unlike the relatively small dispersion and non-persistence among public markets active managers (see Section 4.3).³² The evidence on private equity and venture capital continues to show substantial dispersion and some persistence in top-tier manager performance, but also suggests that as these asset classes have matured and attracted more capital, average excess returns have likely diminished. University endowments benefited from historically high returns to illiquid asset classes in the 1980s and 1990s when alternative illiquid classes were relatively small—more recent evidence suggests that returns in private equity and venture capital have diminished, consistent with these asset classes becoming more mature and mainstream (see, for example, [Harris et al., 2023](#)).

US higher-education endowments provide a useful illustration of the extent to which the endowment model has taken hold, but there is significant heterogeneity across institutions. The 2025 US Higher Education Endowments Report from the National Association of College and University Business Officers (NACUBO) shows that the weighted average of their 658 colleges

³¹See [Swensen \(2000\)](#). For documentation on how other universities' endowments followed Yale in moving towards large allocations to illiquid assets, see [Goetzmann and Oster \(2014\)](#).

³²For the former see [Driessen, Lin, and Phalippou \(2012\)](#) and [Harris, Jenkinson, and Kaplan \(2014\)](#). For the latter see [Carhart \(1997\)](#) and [Fama and French \(2010\)](#).

and universities has an allocation of 29.9 pct to private equity.³³ At the same time, the dispersion in investments to private assets is large. Smaller endowments typically have larger allocations to public and marketable assets and less to private and illiquid assets. As of June 2025, the USD 56.9 billion endowment of Harvard University allocated 41 pct to private equity and only 14 pct to public equity. The remaining allocations were to hedge funds (31 pct), real estate (5 pct), bonds (4 pct), other assets (3 pct), and cash (3 pct).

A practical challenge in implementing the endowment model is that private equity exposure is determined not only by target allocations, but also by the timing of capital calls, distributions, and changes in net asset value (see Section 4.3.2 on the mechanics of investing in illiquid assets). To address this, [Takahashi and Alexander \(2001\)](#) and [Takahashi and Alexander \(2002\)](#) of the Yale Investments Office developed a simple cash-flow model for illiquid alternative assets that has become a standard practitioner tool for planning private market commitments. Their framework projects net asset value, capital calls, and distributions through time and is used to manage commitment pacing—that is, the process of staggering commitments across vintages so as to maintain a relatively stable target allocation to private equity. More recent work extends the Yale framework by making cash flows more responsive to economic conditions. [Siegel \(2008\)](#) and [Cao and van Beek \(2025\)](#), for example, allow capital calls, distributions, and NAV growth to depend on systematic macroeconomic factors as well as fund-specific characteristics, making the model better suited to scenario analysis, stress testing, liquidity management, and multi-asset portfolio construction. These types of extensions to the Takahashi-Alexander model preserve the central practical role of the original Yale model while making it more useful for institutional risk management.

The endowment model has an important weakness that large allocations to private markets can create liquidity pressure when the institution faces unexpected cash needs or adverse shocks. The high allocations to illiquid investments resulted in liquidity squeezes during the Global Financial Crisis.³⁴ Liquidity squeezes have also recently re-emerged because in addition to lower returns from private equity, research universities in the US have also recently found that large allocations to private markets have constrained their ability to tap endowment assets to meet short-term liquidity demands from a new tax on endowment investment returns and reduced grant funding.³⁵

The endowment model is also difficult to scale because it relies on flexible governance, tolerance for illiquidity, and sustained access to oversubscribed managers. These features are available to only a subset of institutions. As a result, the endowment model should not be

³³See [National Association of College and University Business Officers \(2025\)](#).

³⁴See, for example, [Bloomberg \(2026\)](#).

³⁵See, for example, [Ang \(2010\)](#) for a discussion of the Harvard endowment in the Global Financial Crisis.

viewed as a universally dominant template, but rather as a particular institutional solution that works best for investors with unusually strong governance, stable capital, and privileged access to illiquid opportunities.

4.5.5 Total portfolio approach

The total portfolio approach (TPA) is a more recent approach to institutional portfolio construction that eliminates strict asset class categories and constructs portfolios based on exposures to broad factors, or drivers of return, across asset classes. Rather than treating equities, bonds, private equity, real estate, and hedge funds as separate silos, TPA evaluates each investment in terms of its contribution to the overall portfolio, including its exposure to broad risk factors such as equity markets, interest rates, inflation, growth, and illiquidity. In this sense, TPA is closely related to the factor models of Section 4.2 and the underlying drivers of returns in Section 4.4: what matters is not the label attached to an asset, but the systematic risks and implementation costs it brings to the total portfolio.

In practice, the two most commonly used factors are equities and bond themselves. These two factors are mixed in a reference portfolio—which makes the TPA reference portfolio take the same form as a simple 60-40 equity-bond mix that underlies SAA (see Section 4.5.1).³⁶ With two equity-bond factors, TPA can therefore be viewed as a two-factor model in which the institution first determines its desired exposure to the two dominant systematic sources of risk—equity and duration—and then evaluates all investments relative to that benchmark. This creates a clear separation of responsibilities in governance. A stakeholder, board, or asset owner (the principal) sets the reference portfolio to reflect the institution's risk appetite, while the investment manager (the agent) is tasked with outperforming that portfolio subject to explicit risk limits.³⁷ The key point is that investment opportunities compete against one another at the total-portfolio level, rather than within rigid asset-class buckets (see Elkamhi and Lee, 2025).³⁸

A central insight of TPA is that many investments are combinations of the same underlying risk exposures. Following the exposition of Ang, Brandt, and Denison (2014), one can consider a baseline reference portfolio that is 60 pct equities and 40 pct bonds. An institution might select a global equities manager, funded from the equities position in the reference portfolio. Alternatively, a private equity fund can be represented by 130 pct equity and –30 pct bonds (reflecting the leverage taken by the general partner). A USD 1.00 investment in the private equity fund can be funded by selling USD 1.30 in equities and buying USD 0.30 in bonds. From the per-

³⁶TPA can also use macro factors like economic growth, inflation, and real rates (Bass, Gladstone, and Ang, 2017).

³⁷The equity-bond reference portfolios are 85/15 for CPPIB, 70/30 for GPFG, 80/20 for NZ Super, and 65/35 for GIC.

³⁸Some educational material from industry organizations and investment managers on the TPA includes CAIA Association (2024), Franklin Templeton (2025), and Thinking Ahead Institute (2025a). Garmarsh (2025) studies the TPA adopted by CPPIB.

spective of the total portfolio, both investments load on similar underlying risks, even though they sit in different asset class buckets. TPA therefore gives the investment manager flexibility to express desired factor exposures through different assets and managers, depending on expected returns, governance capacity, liquidity considerations, and comparative advantage in implementation.

Several large sovereign wealth funds have adopted TPA, including CPPIB, Australia Future Fund, GIC, and NZ Super. Other large, notable pension funds have recently introduced, or plan to introduce the TPA including CalPERS.³⁹ [Thinking Ahead Institute \(2025b\)](#), p. 19), established by the consulting firm WTW, studied 26 large institutional asset managers and claimed there was a 1.3 pct difference in returns over a 10-year period between the institutions adopting the TPA and institutions with traditional strategic asset allocation.⁴⁰ However, they acknowledge there are “data issues” and both the number of funds and the length of the sample are small. The study also does not account for systematic risk factors or liability characteristics. The Thinking Ahead Institute emphasizes that TPA should be viewed as both a portfolio construction methodology plus a governance framework where principals set reference portfolio benchmarks and agents take active risk versus the benchmark. The agent can assess common risks and exposures across asset classes, investments, and managers, and identify unique idiosyncratic investment opportunities.

TPA also differs from the endowment model in how it is implemented organizationally. [Døskeland and Strömberg \(2018\)](#) distinguish between the classic endowment model (Section 4.5.4) and the “Canada model,” which is another term that often refers to TPA in practice because several large Canadian institutions were early adopters of TPA. The endowment model relies heavily on privileged access to oversubscribed funds by top-performing GPs, uses external managers almost exclusively, operates with small internal staff, and seeks to capture illiquidity premiums through manager selection and liquidity risk management. The TPA or Canada model places greater emphasis on fee reduction strategies, economies of scale, relies more on internal investment teams, and consequently has relatively large numbers of internal staff. It aims to capture the illiquidity premium through long-term liabilities, a liquid asset portfolio, and flexible governance. [Døskeland and Strömberg \(2018\)](#) conclude that for a giant institutional investor like Norway's Government Pension Fund Global, the endowment model may be harder to implement whereas the Canada model is more scalable. For an institution of ATP's scale, elements of both models may be relevant.

³⁹See [CalPERS \(2025\)](#).

⁴⁰See [Thinking Ahead Institute \(2025b\)](#).

4.5.6 Tactical asset allocation

Institutions seek to generate incremental returns by deviating from their SAA portfolios in two ways: tactical asset allocation (TAA) involves adjusting broad market and factor exposures through time, whereas manager and security selection aim to generate excess returns relative to those exposures. We discuss TAA in this section and manager and security selection in the next section.

*Tactical asset allocation is the dynamic management of beta exposures around the long-run benchmark beta portfolio.*⁴¹ Whereas SAA defines the institution's normal or policy allocation, TAA reflects the view that expected returns, volatilities, and correlations vary over time, so that the attractiveness of different asset classes and factors also changes. An institution may, for example, increase equity exposure when valuations are low and expected returns are high, reduce duration exposure when bond risk premiums are compressed, or shift between regions, inflation-sensitive assets, and credit depending on macroeconomic conditions. In other words, TAA is the practical counterpart to the dynamic portfolio choice problem discussed in Section 4.4.2 and is a form of a Merton-Samuelson intertemporal hedging demand. The objective is not to replace the strategic benchmark, but to tilt around it when the short- to medium-term investment opportunity differs from its long-run average.

In practice, TAA can be implemented through cash reallocations, derivative overlays, or separate risk budgets assigned to internal teams or external managers. Large asset owners can implement tactical asset allocation through portfolio overlays, which are long-short portfolios that are overlaid on the SAA, or they can set dedicated allocations of capital or risk as part of their strategic asset allocations (see [Ang, Goetzmann, and Schaefer, 2009](#); [Ilmanen, 2011](#)). Of course, TAA generally involves trading only liquid asset classes as it is difficult to dynamically allocate to illiquids. The objective in TAA is not to overturn the strategic benchmark, but to vary exposure to broad compensated risks when the near- to medium-term opportunity set differs materially from its long-run average. Successful TAA requires not only forecasting ability, but also governance for the institution to act on its views. Tactical positions may underperform for extended periods, and many institutions face organizational frictions that make it difficult to maintain conviction when markets move against them.

4.5.7 Manager and security selection

Manager and security selection are ways institutions seek to capture alpha. In liquid markets, this usually means selecting a manager (internal within the organization or external) who can select securities to outperform a benchmark after controlling for market, style, and macro fac-

⁴¹Skill at timing passive asset classes or factors is also a form of alpha. See, among others, [Henriksson and Merton \(1981\)](#) and more recently [Hodges et al. \(2017\)](#).

tor exposures. The benchmarks for the liquid asset classes in the SAA may be implemented passively at low cost, so the active decision is whether a manager has sufficient skill, information, or implementation advantage to justify deviating from it. Manager selection is typically done within an asset class, and the manager overweights (underweights) securities that are expected to outperform (underperform) the benchmark. Put differently, active strategies are a benchmark-relative concept: active returns are earned in excess of what could have been obtained by holding the relevant passive benchmark or systematic exposures.

Despite the fact that alpha is hard to find (see Section 4.4.3), investment practice often assumes alpha targets for liquid asset classes and incorporates the alpha targets into equity and bond allocations. The famous [Black and Litterman \(1992\)](#) model, for example, shows how to embed investor views (alpha assumptions) on top of equilibrium asset returns implied by market capitalization weights.⁴²

In public markets, manager selection programs aim to identify active managers who can add value net of fees relative to passive benchmarks, but the academic evidence is weak. The academic evidence suggests that this is difficult though not impossible. [Fama and French \(2010\)](#) show that, for mutual funds, most extreme performance can be explained by luck rather than persistent skill, especially after fees. [Berk and van Binsbergen \(2015\)](#) and [Pástor, Stambaugh, and Taylor \(2015\)](#) find stronger evidence of persistent differences in managerial skill—but they find decreasing returns to scale, so that even when skill exists, its value is eroded as assets under management grow. For large asset owners, these results imply that it is not enough that a manager outperforms a benchmark—but the manager must be able to do so at scale.

Hedge funds are typically treated as a distinct asset class allocation to capture alpha although, many purported hedge fund strategies turn out to be exposures to systematic factors such as value, momentum, carry, or volatility selling, rather than true idiosyncratic skill (Asness, Krail, and Liew, 2001; Fung and Hsieh, 2004). Empirical evidence shows that after fees and survivorship biases and controlling for risk, hedge fund alphas have decreased in recent periods, with an especially sharp decline in hedge fund alphas since the Global Financial Crisis.⁴³ Hedge fund alpha also shrinks with hedge fund size ([Barras, Gagliardini, and Scaillet, 2022](#)).

It is not possible to separate alpha from beta in illiquid asset classes lacking low-cost, passive benchmarks. Indeed, the high dispersion and persistence of manager performance in private markets ([Kaplan and Schoar, 2005](#); [Harris, Jenkinson, and Kaplan, 2014](#)) mean that skill in manager selection is paramount for realizing superior outcomes in these asset classes. Thus,

⁴²Quantitative approaches for determining the alpha target include [Grinold and Kahn \(2000\)](#) and [Clarke, Silva, and Thorley \(2002\)](#).

⁴³See [Sullivan \(2021\)](#) and [Yang et al. \(2024\)](#).

selecting top-tier managers have a first-order effect on outcomes. The practical challenge for institutions is therefore to distinguish between the parts of performance that reflect true skill, those that reflect systematic but hard-to-benchmark exposures, and those that are simply compensation for illiquidity, leverage, or bearing poorly understood risks. Indeed, although academics benchmark illiquid investments to the same market and style factors in liquid markets, most institutional investors do not.

4.5.8 Governance

*Agency frictions are pervasive in investment management, and the economics literature shows how optimal governance arrangements can mitigate—but often not eliminate—them.*⁴⁴ Principal-agent issues arise between the ultimate beneficiaries of funds and their representatives (often a board), between a board and the investment management of the fund, and between the investment staff and internal portfolio managers or external fund managers.

Benchmarks are among the most important governance mechanisms in delegated investment management. In TPA (see Section 4.5.5), the adoption of the reference portfolio makes clear the choice of risk versus returns by a board—with higher equity weights in the reference portfolio corresponding to higher target returns, but this is only possible with higher change of loss. Ideal benchmarks should be tradeable, investable, transparent, low cost, and represent viable alternatives to active management (see [Ang, Goetzmann, and Schaefer, 2009](#)). This makes the benchmark a base portfolio that the manager can replicate and against which value-added can be measured.⁴⁵ [Ang \(2014\)](#) recommends that boards do not outsource the level of risk to be taken and the key sources of risk premiums that can be harvested by the fund—as both of these depend on the characteristics of the institution and the nature of liabilities.⁴⁶

The principal (or asset owner) can place limits on the amount of risk taken by the agent (or investment manager) by imposing tracking error (TE) limits around benchmarks. (See also Section 4.4.3.) TE limits control the deviation the investment manager can take from the benchmark. Tracking error constraints control risk-taking, but can also limit the scope of genuine alpha and induce benchmark hugging (see [Jorion, 2003](#)). There is a benefit to tracking error constraints when alpha is uncertain because it limits unskilled managers from choosing overly risky portfolios ([Buffa, Vayanos, and Woolley, 2022](#)).

⁴⁴See [Ang \(2014, Chapter 15\)](#) for principal-agent issues in delegated investment management. The first paper to tackle principal agent problems in economics is [Ross \(1973\)](#).

⁴⁵Despite their ubiquity in investment management, [Admati and Pfleiderer \(1997\)](#) show that when agents' compensation is a linear function of the benchmark, the agents' actions amazingly do not depend on the benchmark when there are no position constraints or risk constraints.

⁴⁶While benchmarks are beneficial to align principal-agent behavior, they may have adverse macro consequences. [Kashyap et al. \(2023\)](#) show that too much benchmarking inflates prices, decreases expected returns, leads to crowding, and thereby decreases the effectiveness of benchmarking as a governance tool for everyone.

Investment managers are often evaluated not only against benchmarks but also relative to peer groups. Peer benchmarking leads to herding, even when investment managers have different benchmarks, due to common career or reputational concerns ([Scharfstein and Stein, 1990](#)). When peers outperform, the perceived risk of lagging behind peers can exceed the penalty for losing money during drawdowns, creating an asymmetry that encourages managers to avoid distinctive positions ([Chevalier and Ellison, 1997](#)). [Goyal and Wahal \(2008\)](#) and [Jenkinson, Jones, and Martinez \(2016\)](#) show that in institutional settings, peer effects are exacerbated by consultants and boards, which measure success and make hiring and firing decisions in peer-relative terms.

Overall, good governance structures can significantly increase portfolio returns, comparable to decisions on asset classes, risk premiums, and risk levels. The challenge is balancing agency control mechanisms with incentivizing skilled active managers to take risk and generate incremental returns. Excessive intervention by the principal (a board or a supervisory body) can reduce the agent's incentive to create value ([Aghion and Tirole, 1997](#)). TPA offers one governance model where principals set long-term strategic benchmarks aligned with risk appetites and desired target levels of return, while agents have the freedom to take active risk around the benchmarks.

4.5.9 Currency hedging

When foreign exchange rates (FX) are freely determined, an international asset has two sources of returns—the local asset return and the return from converting the foreign currency exposure to domestic currency. It is possible to hedge the latter, and the optimal currency hedge is a function of investment horizon, interest-rate differentials, and the covariance of currency returns with local and global factors ([Campbell, Serfaty-de Medeiros, and Viceira, 2010](#); [Opie and Riddiough, 2020](#)).

In practice, many institutions often have near-full hedging for international fixed income and partial (often substantially below 100 pct) or no hedging for international equities.⁴⁷ This practice partly reflects differences in asset class volatility relative to currency volatility. For fixed income, currency volatility typically exceeds bond return volatility, meaning unhedged positions are dominated by currency movements rather than the underlying asset returns. Conversely, equity return volatility generally exceeds currency volatility, making currency exposure a smaller component of total risk and returns. (The larger equity volatility also means it is more expensive to hedge equities than fixed income.) These practices are consistent with

⁴⁷See [Cheema-Fox and Greenwood \(2026\)](#). [Du and Huber \(2026\)](#) show that non-US investors have increased USD hedges over the past two decades, despite higher hedging costs.

findings in the academic literature.⁴⁸ The literature also shows that, on average, currency risk is predominantly idiosyncratic (diversifiable) and not rewarded over long periods. This makes currency allocations different from equity and bond decisions because currencies primarily add risk without significant long-term returns.

While currency hedging is often a long-term asset allocation decision, the expected returns of currencies are predictable in the short run. Some predictors of FX returns found in the literature include value, carry, and momentum factors.⁴⁹ This predictability means that there is opportunity for tactical positioning across currencies and explicitly constructing optimal FX hedges with risk reduction, alpha enhancing, or combinations of both as objective functions, as [Eaker and Grant \(1990\)](#), [Boudoukh et al. \(2019\)](#), and [Coiai et al. \(2021\)](#) advocate.

4.6 Pension industry trends

Key message

The pension industry, both internationally and in Denmark, has seen substantial change since the turn of the millennium. One major shift is the rise of funded, asset-backed pension systems, easing the burden on public finances—though many countries, particularly in the EU, still face substantial fiscal challenges from pension obligations.

Denmark stands out: large pension savings, and a retirement age indexed to life expectancy. The high Danish pension age supports the combination of relatively low Pillar 2 contributions and a high replacement rate. The coverage of occupational pension funds, however, remains a weakness of the Danish system.

A second major shift has been the move from defined benefit (DB) to defined contribution (DC) schemes. In Denmark this is visible in the gradual disappearance of guaranteed products and the growth of market-rate pensions.

The product shift has fed through to asset allocation: pension funds, internationally and in Denmark, have moved away from bonds and toward illiquid or private investments. Average nominal returns for OECD pension funds over the last 20, 10, and 5 years have been 5.7, 5.0, and 5.1 pct, respectively; for Danish funds, 5.0, 3.7, and 2.6 pct, respectively. Danish funds, and the average OECD fund, had negative real returns over the last 5

⁴⁸See, among others, [Perold and Schulman \(1988\)](#), [Glen and Jorion \(1993\)](#), [Campbell, Viceira, and White \(2003\)](#), and [Campbell, Serfaty-de Medeiros, and Viceira \(2010\)](#).

⁴⁹See [Asness, Moskowitz, and Pedersen \(2013\)](#), [Lustig, Roussanov, and Verdelhan \(2011\)](#) and [Lustig, Roussanov, and Verdelhan \(2014\)](#), and [Kojen et al. \(2018\)](#). See also [Chernov, Dahlquist, and Lochstoer \(2023\)](#) and [Chernov, Dahlquist, and Lochstoer \(2026\)](#) for analyses of priced and unpriced risks in currency strategies like dollar, carry, momentum, and value.

Key message (continued)

years, reflecting the inflation spike.

Solvency coverage ratios for Danish funds average around 250 pct, although these figures should be interpreted with care as they are less meaningful for funds without guarantees. Nevertheless, the lowest solvency coverage ratios of around 200 pct are illustrative of the high buffers most pension funds operate with.

This section reviews the major trends and features of the international and Danish pension industry, with a focus on developments that put the characteristics of ATP's pension product and investment strategy into perspective. We first cover nine international observations: funded pension systems, replacement rates, coverage, life expectancy and retirement age, public pension expenditures, contribution rates, the DB-to-DC shift, asset allocation, and returns. Denmark's relative position is shown throughout. We then address six Danish observations in more detail: the move to market-rate products, asset allocation, home bias, FX hedging, solvency, and returns.

4.6.1 International trends

Observation 1: Funded (asset-backed) pension systems

Funded pension systems have grown substantially, but with large differences across countries.

Funded or asset-backed pensions cover all arrangements in which retirement savings are invested, earn a return, and finance retirement out of the accumulated assets. They can be public or private, occupational or personal, and they include public reserves built up to support state pensions. The stock of assets earmarked for retirement has grown over the past two decades, with the ratio of pension assets to GDP doubling in many countries (Exhibit 4.11). Across the OECD, total pension assets reached 95 pct of GDP at end of 2024. The cross-country dispersion is wide. In eight OECD countries—typically those with long-established pension systems—assets exceeded GDP. At the other end, the asset-to-GDP ratio was below 20 pct in 17 OECD countries, including large European economies such as France and Italy; Greece had the lowest ratio. Denmark stands out, with pension assets at around 200 pct of GDP. Note that for simplicity, in the country-based OECD exhibits in this section, we have reduced the numbers of countries shown compared to the original exhibits in the OECD publications. OECD has 38 member states in total and here we select countries out of the 20 OECD countries (in addition to Denmark) with the largest GDP per capita as these countries are most relevant in the context of the Danish pension system and ATP.⁵⁰

⁵⁰Even if Norway is part of the OECD, Norway is not included in all the data presented below.

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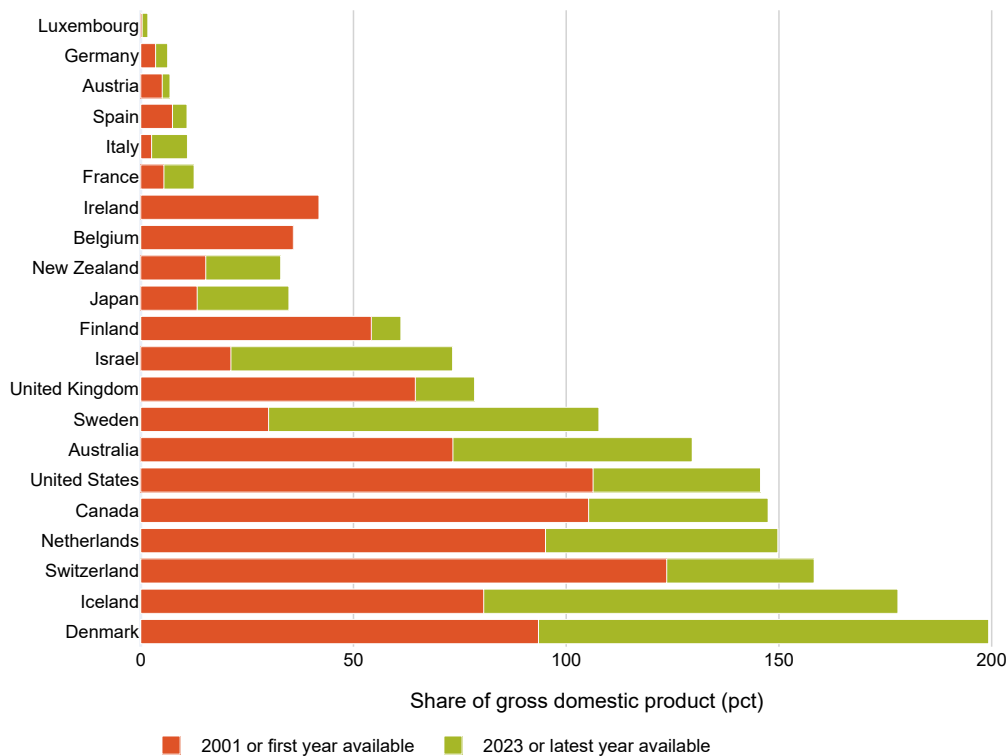


Exhibit 4.11: Assets earmarked for retirement in selected countries, 2001 versus 2023. Bars show pension assets as a percentage of GDP. The 2001 observation refers to the earliest available year (in parentheses where it differs from 2001): Belgium (2005), Finland (2011), France (2006), Luxembourg (2005), Spain (2002). The 2023 observation refers to 2023 except for Belgium (2020). Source: OECD Pensions Outlook 2024 (Figure 1.1); see the OECD's Pension Markets in Focus 2024 for country-specific notes.

Observation 2: The replacement ratio

Replacement ratios—pensions relative to prior earnings—differ markedly across countries and income levels, with Denmark particularly high at the low-income end. The OECD average replacement ratio is 65.5 pct for low-income earners and 42 pct for high-income earners. Denmark, with a replacement ratio above 100 pct for low-income earners, is second only to Mexico (Exhibit 4.12; Mexico not shown, see above). The Danish replacement ratio for high earners is also high by OECD standards, but it is more similar to many other countries.

Exhibit 4.12: Gross pension replacement ratios from mandatory and voluntary private pension schemes, full career workers. The OECD average refers to the average of all 38 OECD countries. Note that Pillar 3 pensions are not included. Source: OECD Pensions at a Glance 2025 (Table 8.1).

Share of the average wage level (men)	Total mandatory			Total with voluntary		
	50 pct	100 pct	200 pct	50 pct	100 pct	200 pct
Australia	71.3	40.8	26.4			
Austria	74.1	74.1	52.5			
Belgium	61.7	43.5	28.2	65.3	52.5	51.9
Canada	47.3	37.1	18.5	67.9	57.7	39.2
Denmark	115.2	72.7	53.6			
Finland	57.8	57.8	57.8			
France	56.6	56.6	47.4			
Germany	46.3	42.1	30.2	56.8	53.4	41.4
Iceland	69.3	43.9	43.4			
Ireland	48.5	24.3	12.1	78.4	54.1	42.0
Israel	62.3	42.8	21.4	79.7	56.1	28.1
Italy	70.6	70.6	70.3			
Japan	51.4	36.5	29.0			
Luxembourg	88.4	75.6	69.2			
Netherlands	86.6	74.7	68.8			
New Zealand	64.7	39.5	19.7	85.0	59.5	39.5
Norway	59.5	46.1	28.4			
Spain	80.6	80.4	49.9			
Sweden	64.2	63.7	78.3			
Switzerland	55.4	42.4	21.5			
UK	65.6	44.7	29.9			
US	50.5	39.7	28.5	85.6	74.8	63.6
OECD	65.5	52.0	42.0	70.0	56.6	47.1
EU27	64.3	54.5	46.9	67.3	57.6	50.5

Observation 3: The coverage ratio

The coverage ratio—the share of the working-age population participating in a pension system—has risen markedly across the OECD, but Denmark sits at the low end on the narrow measure used in OECD comparisons. Where many countries had participation ratios of 50–70 pct a decade or two ago, most are now at 80 pct or above (Exhibit 4.13). Denmark's participation

rate is just under 70 pct for mandatory asset-backed pension systems. This figure excludes ATP Lifelong Pension; including ATP, the Danish coverage rate rises to around 90 pct (see Exhibit 4.12). Denmark is also an outlier in its treatment of the self-employed. In most OECD countries, the self-employed face mandatory contributions to either an earnings-related or a basic pension scheme; in Denmark, contributions are voluntary, including to ATP (see Section 5.2).⁵¹ As a result, the pension of a self-employed Danish worker can be as low as half that of an employee.⁵²

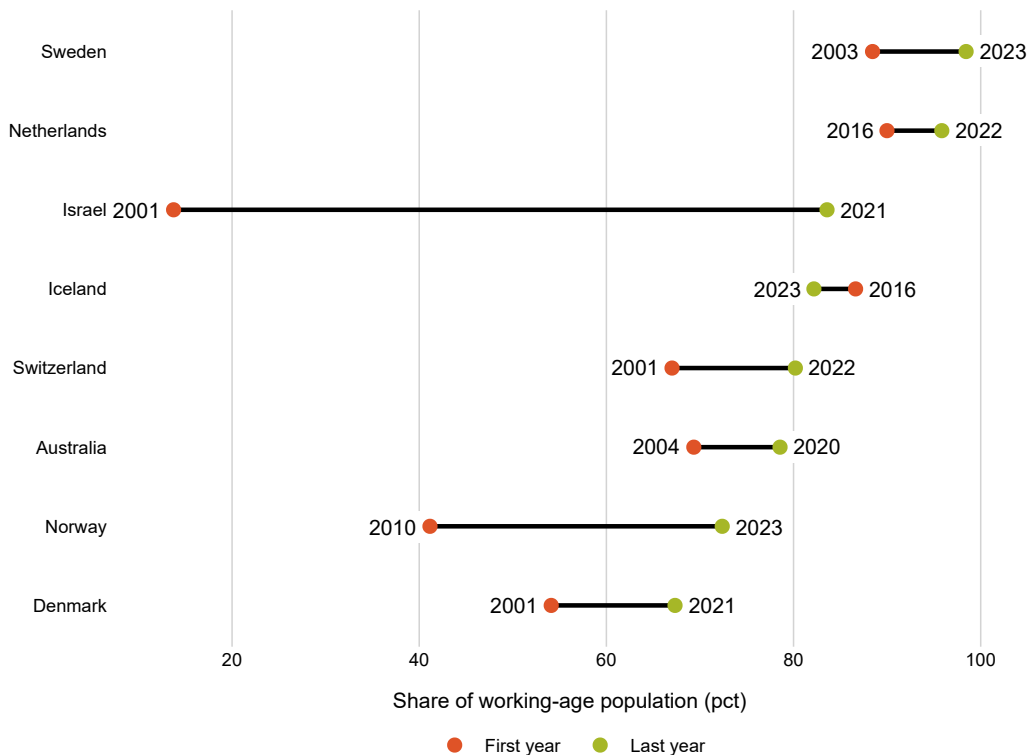


Exhibit 4.13: Proportion of the working-age population participating in asset-backed pensions. Voluntary or auto-enrolled pension schemes are not included. For each country, the longest period available is shown. Source: OECD Pensions Outlook 2024 (Figure 1.2).

Observation 4: Life expectancy and retirement ages

Life expectancy has risen significantly in recent decades. Between the mid-1990s and the early 2010s, longevity grew strongly: across the 38 OECD countries, life expectancy at age 65 rose by around 1.5 years per decade. The pace has since slowed. On average across the OECD, life expectancy at age 65 is projected to rise by 1.0 years over the next decade, slowing to 0.9 years per decade around 2050.

⁵¹OECD Pensions at a Glance 2025, Table 5.5 page 189.

⁵²OECD Pensions at a Glance 2025, Figure 5.6 page 189.

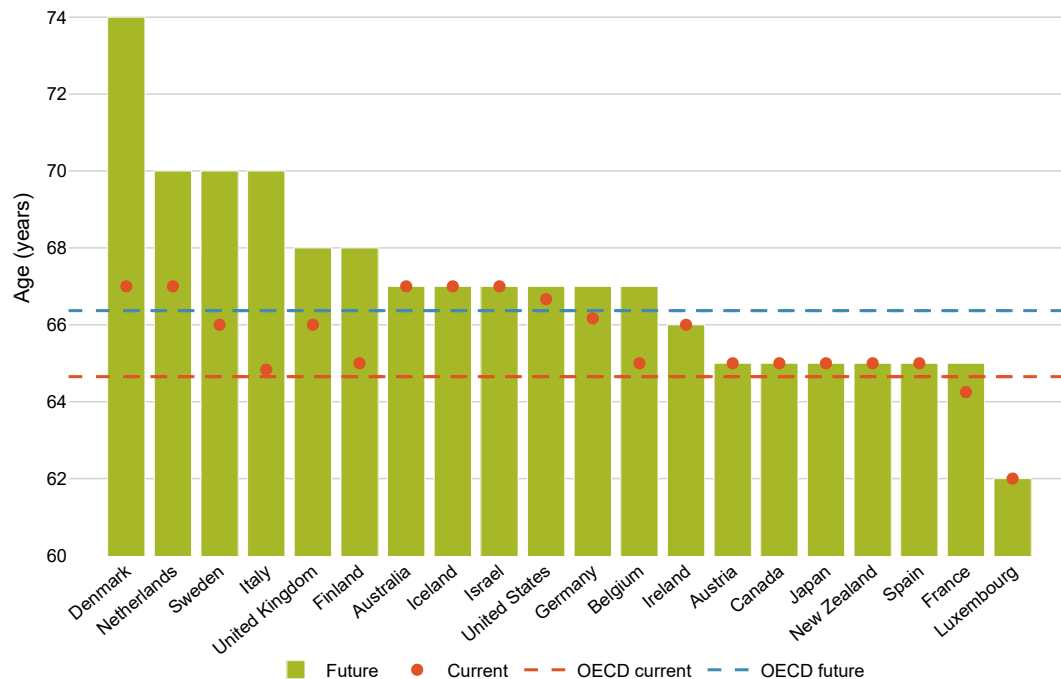


Exhibit 4.14: Normal retirement ages for men entering the labor market at age 22 with a full career. “Current” refers to people retiring in 2024. “Future” refers to the age from which someone is eligible to full retirement benefits from all mandatory components assuming full career from age 22 in 2024. Source: OECD Pensions at a Glance 2025 (Figure 1.12).

Rising longevity puts pressure on public finances, and it is becoming increasingly common to link retirement age to life expectancy. In 2024, the average normal retirement age for men in the OECD was 64.7 years, defined as the age at which someone working full-time from age 22 becomes eligible for full retirement benefits across all pension components. It ranges from 62 years (Colombia, Greece, Luxembourg, Slovenia) to 67 years (Denmark, Iceland, the Netherlands, Norway), with Turkey as an outlier at 52 years (Exhibit 4.14). For men entering the labor market in 2024, the OECD average will rise to 66.4 years on the basis of already-legislated measures, with half of OECD countries raising the normal retirement age. Cross-country differences are set to widen: the normal retirement age will remain at 62 in Luxembourg and Slovenia, while it is expected to reach 70 years in Italy, the Netherlands, and Sweden—and 74 years in Denmark, reflecting its established link between retirement age and life expectancy.

Observation 5: Public expenditures on pensions

Public pension expenditures account for a large and rising share of GDP in many countries, but Denmark sits in the lower half, and its relative position is projected to improve. Across the OECD, public pension expenditures averaged 9.0 pct of GDP in 2025 and are projected to rise to 10.3 pct by 2060, see Exhibit 4.15. Many EU countries already spend above 12.5 pct of

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GDP, with further increases ahead. Denmark spent 8.9 pct in 2025 and is projected to spend 6.9 pct in 2060—the decline reflects the rising retirement age, illustrating the long-run fiscal benefit of indexing retirement age to longevity.

Exhibit 4.15: Projections of public expenditure on pensions, 2023–2060, percentage of GDP. Values are in percent of GDP. Blank cells indicate that projections are not reported. Source: OECD Pensions at a Glance 2025 (Table 8.4).

	2023/24	2025	2030	2035	2040	2045	2050	2055	2060
Australia	2.4	2.5	2.4	2.3	2.2	2.1	2.1	2.0	2.0
Austria	13.7	14.5	15.0	15.0	14.6	14.2	14.0	14.0	14.0
Belgium	12.8	13.1	13.6	14.1	14.4	14.6	14.8	15.1	15.4
Canada	6.5	7.2	7.8	8.0	8.1	8.1	8.1	8.1	8.3
Denmark	8.7	8.9	9.3	9.2	8.8	8.3	7.8	7.2	6.9
Finland	13.1	13.2	13.3	13.2	12.6	12.3	12.4	12.8	13.3
France	14.1	14.2	14.3	14.3	14.1	13.9	13.7	13.6	13.5
Germany	10.2	10.5	10.8	11.2	11.1	11.0	11.0	11.1	11.2
Iceland	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ireland	3.6	3.7	4.2	4.7	5.0	5.5	6.0	6.2	6.5
Israel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Italy	15.5	16.1	16.6	17.2	17.1	16.5	15.5	14.4	13.7
Japan	9.1	9.1	8.8	8.7	8.8	9.1	9.3	9.5	9.7
Luxembourg	9.4	9.3	9.7	10.6	11.2	11.8	12.5	13.6	15.0
Netherlands	6.6	6.8	7.3	7.7	8.0	7.9	7.9	7.9	8.0
New Zealand	4.9	5.3	5.6	5.9	6.2	6.3	6.5	6.8	7.2
Norway	11.1	11.5	12.1	12.2	12.1	12.0	12.0	12.1	12.2
Spain	13.6	13.7	14.3	15.4	16.2	16.9	17.3	17.2	16.9
Sweden	8.0	7.9	7.6	7.5	7.2	7.0	7.0	7.0	7.3
Switzerland	6.5	6.4	6.8	N/A	N/A	N/A	N/A	N/A	N/A
UK	7.6	8.2	7.9	8.2	8.3	8.3	8.5	8.9	9.5
US	5.2	5.3	5.6	5.8	5.9	5.9	5.9	6.0	6.1
OECD32	8.8	9.0	9.3	9.5	9.7	9.9	10.0	10.1	10.3
EU27	9.9	10.1	10.3	10.6	10.7	10.9	10.9	11.0	11.0

Observation 6: Contribution rates to Pillar 2 pension funds

Contribution rates to mandatory Pillar 2 schemes differ across countries, with Denmark below the OECD average. The effective contribution rate on average earnings is 18.8 pct for the OECD, peaking at 33 pct in Italy, see Exhibit 4.16. In Denmark, the rate is 12.7 pct. High rates in some countries reflect legacy obligations from earlier, less-funded systems. The low Danish rate reflects the high retirement age, which both extends the accumulation period and shortens the decumulation period. This resolves the apparent paradox that Denmark exhibits a high replacement rate with a low contribution rate.

Exhibit 4.16: Mandatory contribution rates in 2024 in pct of gross earnings. Contributions to mandatory and quasi-mandatory pension schemes for private-sector workers. Contribution rates also finance disability or invalidity benefits. The indicated rates cover different social security schemes across countries. OECD averages are for earners at the average wage and do not represent the average of the nominal rate columns. Source: OECD Pensions at a Glance 2025 (Table 8.1).

	Effective rate on average earnings (pct)		Effective rate on average earnings (pct)
Australia	11.5	Luxembourg	16.0
Austria	22.8	Netherlands	22.0
Belgium	16.4	New Zealand	0.0
Canada	9.2	Norway	22.8
Denmark	12.7	Spain	28.3
Iceland	21.8	Sweden	22.3
Ireland	15.1	Switzerland	16.6
Israel	19.3	UK	26.6
Italy	33.0	US	10.6
Japan	18.3	OECD at average wage	18.8

Observation 7: Defined benefit (DB) and defined contribution (DC) pension plans

European countries with large and well-developed pension systems—the UK, the Netherlands, and the Scandinavian countries—are generally moving from DB to DC schemes. In Denmark, this shift is reflected in the move toward market-rate pension products. The most recent and most concentrated transition is in the Netherlands: the Future of Pensions Act, effective in 2023, requires the Dutch pension sector to complete its DB-to-DC transition by the end of 2027. Elsewhere, the shift has unfolded more gradually across OECD countries over many years (Exhibit 4.17).

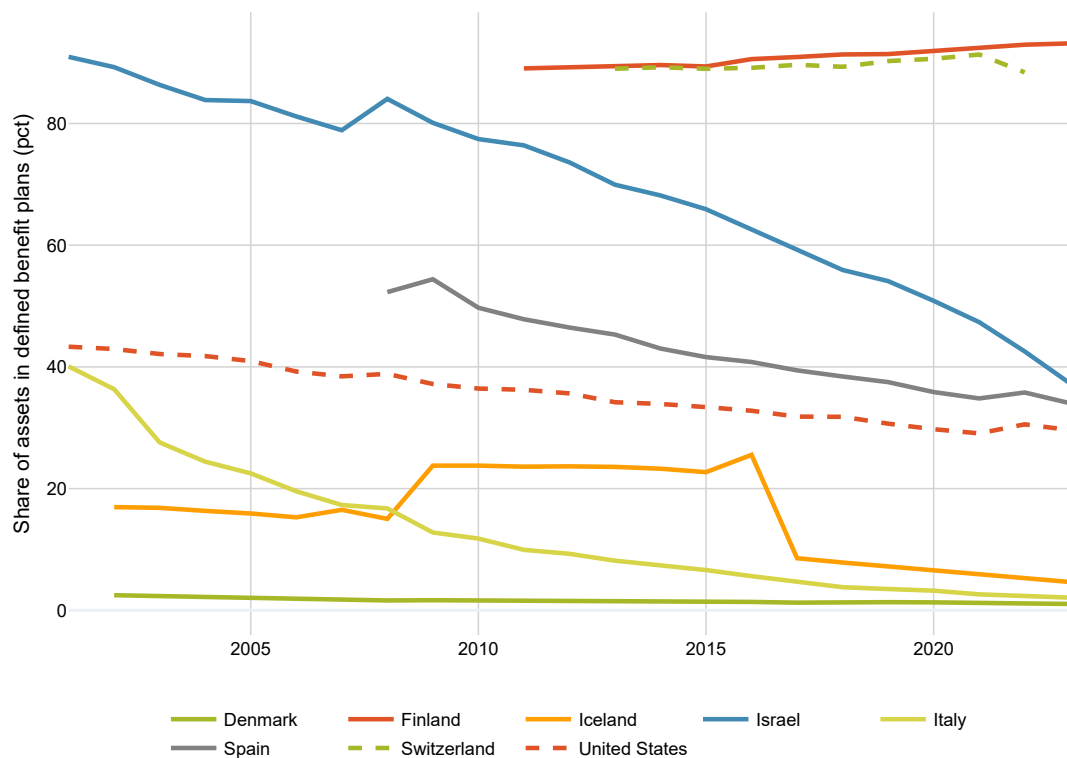


Exhibit 4.17: The share of assets in defined benefit plans in selected countries 2001–23. Defined as a percentage of AuM earmarked for retirement (excluding reserves of unfunded and pay-as-you-go plans). Source: OECD Pension Markets in Focus 2024 (Figure 4.2).

The shift is driven by regulation, the decline in interest rates, and rising longevity. The move to mark-to-market accounting in the early 2000s made DB liabilities more visible and more volatile on sponsors' balance sheets, raising the incentive to convert to DC schemes. The multi-decade drop in interest rates made DB promises harder to meet, since lower discount rates raise the present value of long-dated liabilities—and the shortfall typically falls on the employer-sponsor. Rising longevity raised the cost of guaranteed lifetime benefits along the same channel. We discuss the strains these forces placed on DB sponsors, and the hedging strategies developed in response, in Section 4.1 on liability-driven investment.

Observation 8: Asset allocation of pension funds

The asset allocation of international pension funds has shifted away from bonds and towards private markets. The bond allocation has declined from around 55 pct of assets in 2001 to around 35 pct in 2024 (Exhibit 4.18). Private assets have risen from 12 pct to more than 20 pct over the same period.

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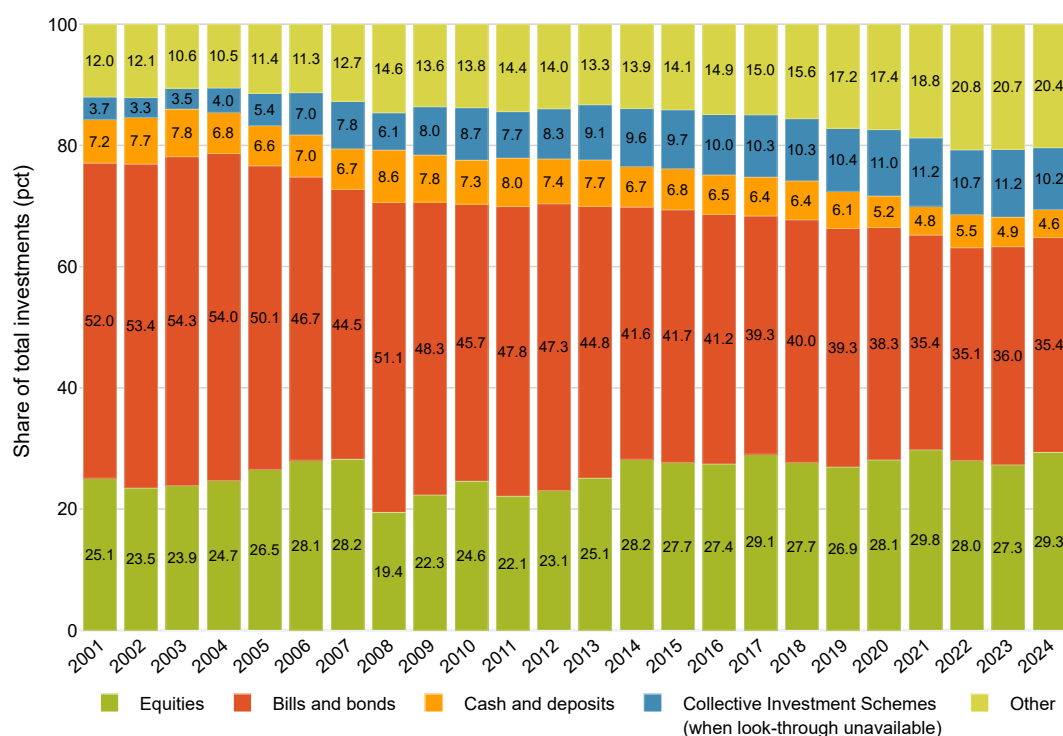


Exhibit 4.18: Average asset allocation of pension providers in selected asset classes and investment vehicles in selected countries 2001–24. The “Other” category includes for example loans, real estate, hedge funds, and private equity. Source: OECD Pension Markets in Focus 2025 (Figure 2.6).

Pension funds generally have large home biases. It is common that less than half of assets are invested abroad (Exhibit 4.19). Small economies tend to invest a larger share abroad, while pension funds across the OECD have generally increased their foreign holdings over the past decade. Denmark sits around the middle of the distribution, with a foreign share of roughly 40 pct using the OECD definition.

Review of ATP's Investment Strategy

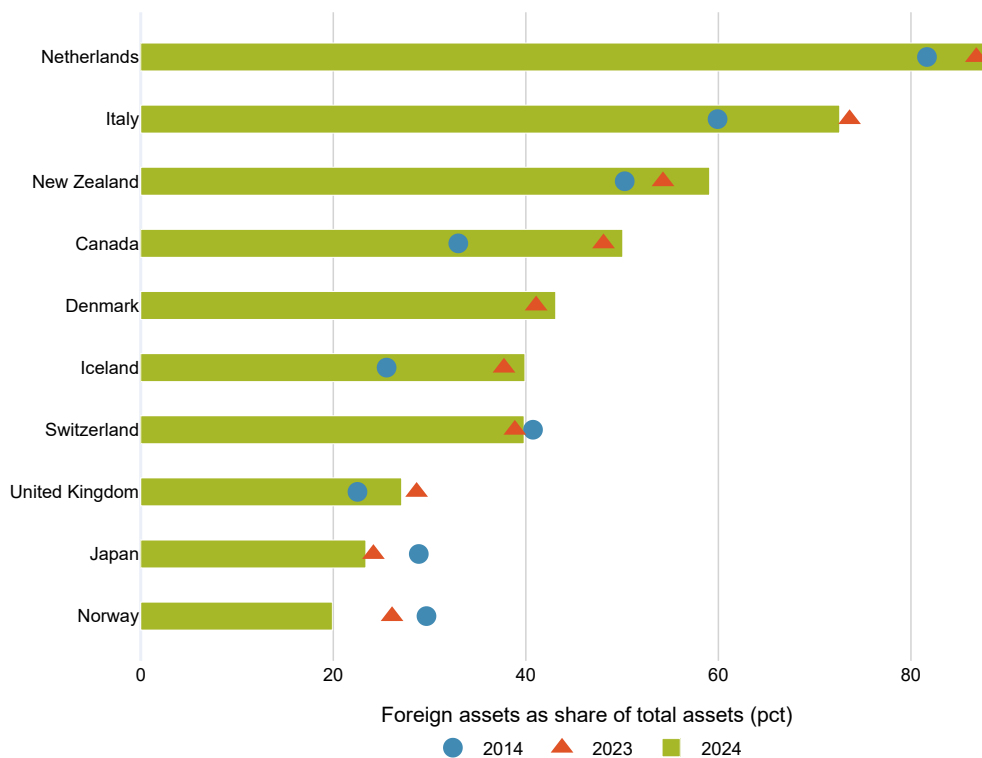


Exhibit 4.19: Foreign investments of pension providers, 2014, 2023, and 2024. Source: OECD Pension Markets in Focus 2025 (Figure 2.7)

Observation 9: Return on investments

Average nominal returns for OECD pension funds (unweighted) over the past 20 years were 5.7 pct; average real returns were 2.0 pct. Both nominal returns and real returns have declined over time. Average nominal (real) returns were 5.7 (2.0) pct over the last twenty years, were 5.0 (1.1) pct over the last 10 years, and 5.1 (−0.5) pct over the last 5 years, see Exhibit 4.20. For Danish pension funds nominal returns over the past 20 years are in line with the OECD; Danish real returns are higher. For Danish pension funds average nominal (real) returns were 5.0 (3.1) pct over the last twenty years, were 3.7 (1.8) pct over the last 10 years and 2.6 (−0.3) pct over the last 5 years. Note how the real returns across OECD and in Denmark over the last 5 years have been negative due to the inflation spike in 2022.

Exhibit 4.20: Nominal and real geometric average annual investment rates of return of pension providers in 2024 and over the last 5, 10, 15 and 20 years in pct. Panel (a) shows nominal returns and Panel (b) shows real returns. The OECD average is calculated as an unweighted average of 34 OECD countries. Source: OECD Pension Markets in Focus 2025 (Table 9.3).

Panel (a): Nominal returns

		5-yr	10-yr	15-yr	20-yr
	2024	annual	annual	annual	annual
		average	average	average	average
Denmark	6.6	2.6	3.7	5.1	5.0
OECD average	9.1	5.1	5.0	5.4	5.7

Panel (b): Real returns

		5-yr	10-yr	15-yr	20-yr
	2024	annual	annual	annual	annual
		average	average	average	average
Denmark	4.6	−0.3	1.8	3.3	3.1
OECD average	5.0	−0.5	1.1	2.0	2.0

4.6.2 Danish trends

Observation 1: Pension contributions

The Danish pension market has undergone a structural shift in recent years: lifelong pensions with both interest-rate and longevity guarantees have given way to non-guaranteed market-rate products. Since 2021, more than half of total provisions have been held in market-rate products (Exhibit 4.21). The shift on the stock side reflects the much faster shift on the flow side: market-rate products' share of new contributions has risen from 15 pct two decades ago to more than 80 pct in recent years.

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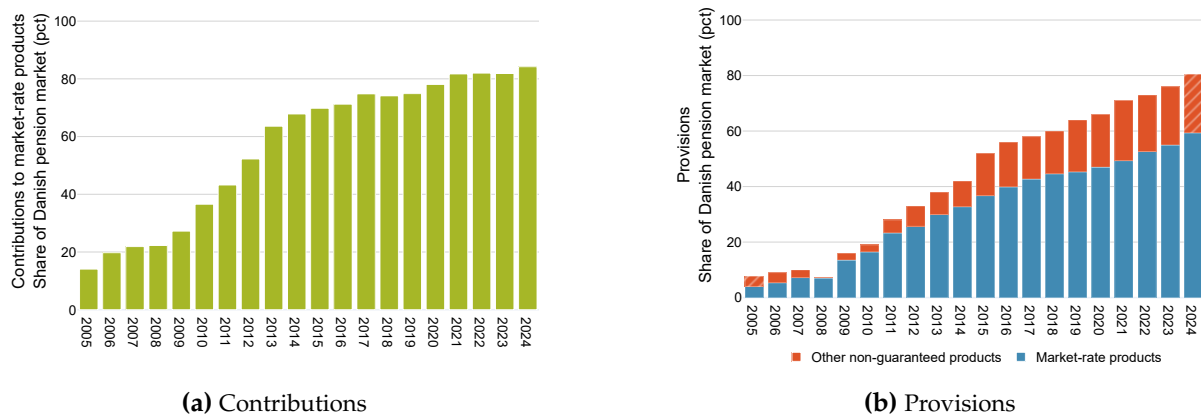


Exhibit 4.21: Share of contributions to market-rate products (Panel (a)) and provisions for non-guaranteed and market-rate products (Panel (b)), respectively, 2005–2024. The series “Contributions to market-rate products” and “Provisions for market-rate products” are based on data from Insurance and Pension Denmark while “Provisions for non-guaranteed products” is based on data from the Danish Financial Supervisory Authority. It is the sum of provisions for market-rate, “none or conditional guarantees” and “guarantees less than or equal to zero.” Note that data from the Danish Financial Supervisory Authority has its last observation in 2023. Source: Insurance and Pension Denmark (Forsikring & Pension) and annual publications from the Danish Financial Supervisory Authority: Livsforsikringselskaber og Tværgående Pensionskasser, Markedsudvikling.

Observation 2: Asset allocations of Danish pension funds

The asset allocation of Danish pension funds has shifted away from bonds and toward equities and private assets. Market-rate products carry a higher equity share and a lower bond share than guaranteed products (Exhibit 4.22). The move toward market-rate products has therefore raised the overall equity share and lowered the overall bond share, while within market-rate products the equity share has risen steadily since 2018.



Exhibit 4.22: Asset allocation in 2025 for average-rate products and market-rate products. Panel (a) illustrates the average allocation for average rate products and Panel (b) illustrates the average allocation for market-rate products. Equities include both listed and unlisted shares. Source: Danish Financial Supervisory Authority: The Financial Sector in Figures: Life Insurance Companies and Pension Funds.

Allocations to private-markets (illiquid) investments have grown over time and reached 17

pct of AuM at end-2023 (Exhibit 4.23). This category includes hedge funds, infrastructure, credit, and private equity. The Danish share is slightly below the OECD average discussed earlier, though not by much. The cumulative exposure of market-rate products to equities and other illiquid private-market investments is high. There seems to be a collective move among pension funds to higher equity exposure, partly driven by a strategy of not delivering lower returns than other funds.

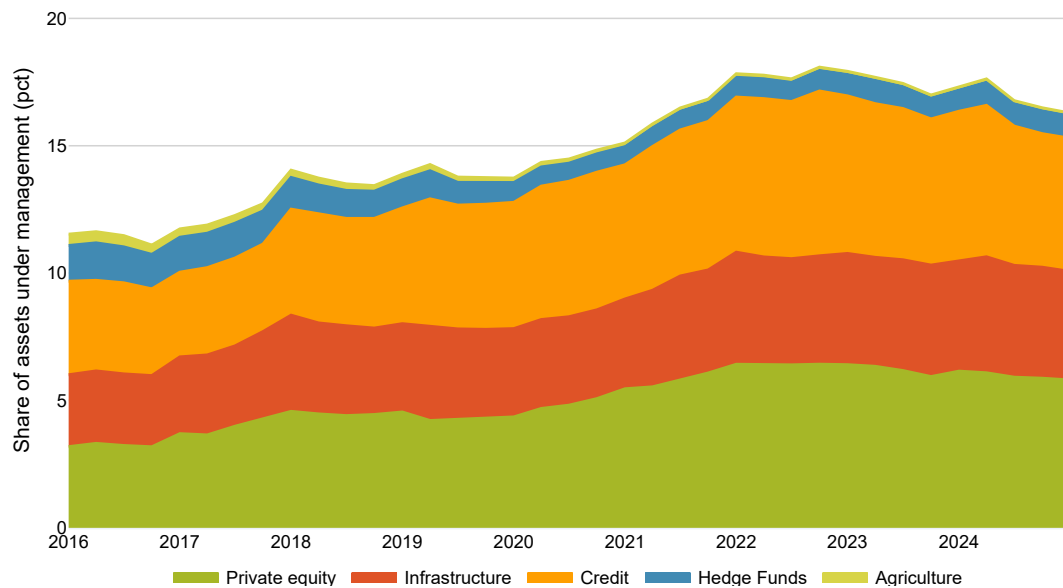


Exhibit 4.23: Development of private markets investments as share of AuM, 2016–2025. Source: Danish Financial Supervisory Authority: The Financial Sector in Figures: Life Insurance Companies and Pension Funds.

Investment risk across the life cycle ranges from 5 pct to 16 pct depending on years to retirement and risk profile. There is also significant overlap of risk profiles between different funds. Exhibit 4.24 illustrates the risk in Danish market-rate products, measured as the annual volatility of the asset allocation for the given allocation. The market-rate products implement a life cycle element, where the investment risk is reduced as the individual approaches the retirement age. A medium-risk market-rate product typically has a volatility between 8 and 13 pct, depending on the number of years to retirement, but with some variation between funds.

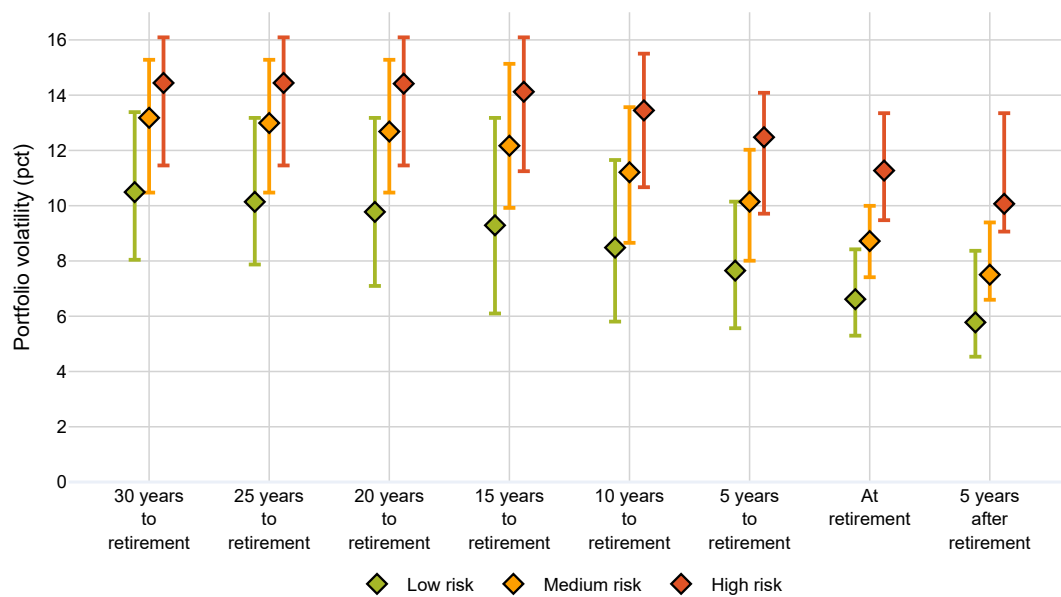


Exhibit 4.24: Risk levels in Danish market rate products over the life cycle. The figure illustrates the risk in Danish market rate products, measured as the annual volatility of the asset allocation for the given allocation. The figure also illustrates different risk profiles. For each combination of risk profile and year to retirement, the point shows the average risk across funds, where the whiskers show the range from minimum and maximum within the given risk profile and years to retirement. Source: Nikolaj Holdt Mikkelsen, [Council for Return Expectations](#), and own calculations.

Observation 3: Danish pension fund home bias

Danish pension funds have a significant home bias. More than 35 pct of AuM are invested in Denmark, and the bias is particularly strong for bonds (Exhibit 4.25) where more than 50 pct are domestic investments. The large allocation to domestic bonds could reflect that pensions are paid in Danish kroner. Around 25 pct of equity holdings are in Danish equities, which also includes unlisted holdings like real estate. Comparing the headline figure of 35 pct foreign investments, this is consistent with the earlier OECD figures where the Danish value for foreign investments was around 40 pct.

The share of foreign investments for Danish pension funds has increased in recent years. At the beginning of 2018, the Danish share of investments was 50 pct. The increase should be seen in the light of the shift in asset allocation in Danish pension funds from bonds towards equities as discussed above. The home bias is usually strongest in bond investments.

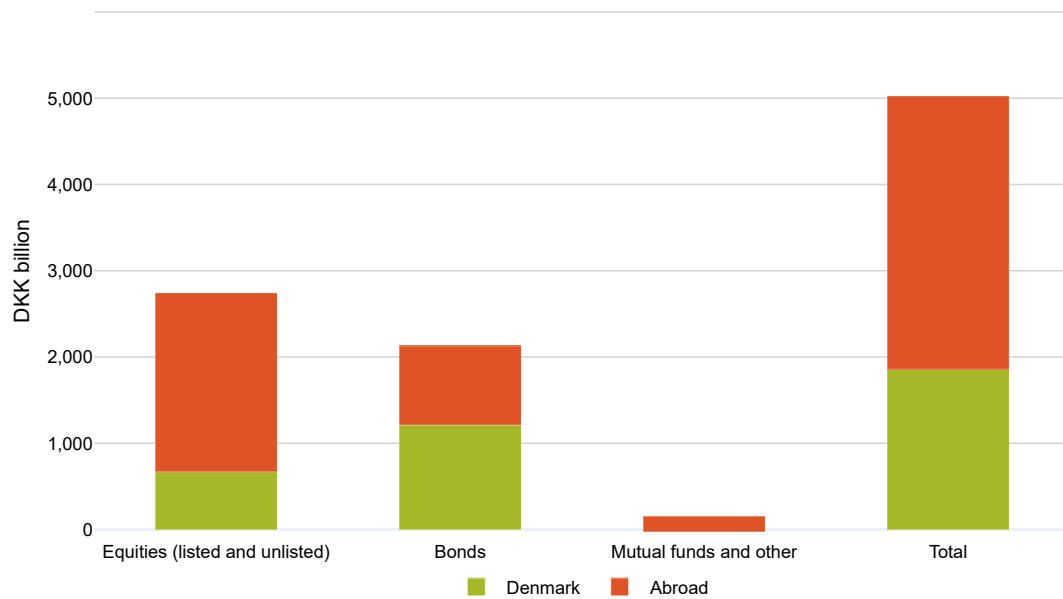


Exhibit 4.25: Distribution of total Danish pension assets between Denmark, and the rest of the world, and split by asset class by end of 2025. Assets include Pillar 1, 2, and 3 in pension and insurance companies. Source: Statistics database of the Danish Central Bank.

Observation 4: Danish pension fund currency hedging

Danish pension funds hedge most of their USD exposure and only part of their EUR exposure. Around 75 pct of US dollar exposure is hedged back to either DKK or EUR. The hedge ratio on euro exposure was 37 pct at end of 2025 (Exhibit 4.26), reflecting the Danish fixed-exchange-rate regime against the euro. For exposures outside USD and EUR, the hedged share was 40 pct, reflecting the higher cost of hedging smaller currencies.

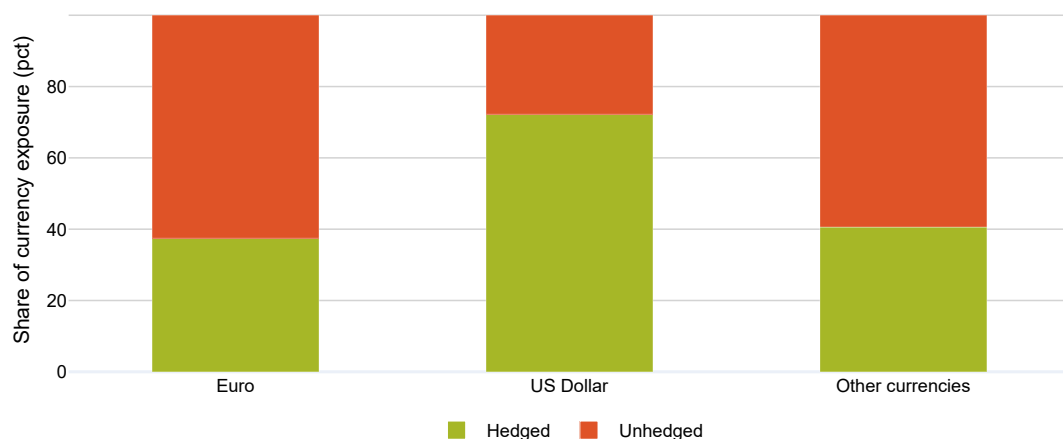


Exhibit 4.26: Total Danish pension assets, split by currency and hedging ratio, by end of 2025. Assets include Pillar 1, 2, and 3 assets for pension and insurance companies. Source: Statistics database of the Danish Central Bank.

Observation 5: Solvency of Danish pension funds

Danish pension funds on average maintain solvency coverage ratios (SCR ratio) of around 250 pct. The lowest is just below 200 pct, see Exhibit 4.27. These figures should be interpreted with care, however. Solvency coverage ratios are not particularly informative for funds without guarantees, since there is no fixed liability to measure assets against. Solvency II itself contains lenient elements—notably, the inclusion of expected future earnings in the capital base. Nevertheless, the lowest solvency coverage ratios are informative as to the high buffers that pension funds normally operate with. See Section 4.1.7 for a theoretical discussion of capital requirements and solvency ratios.

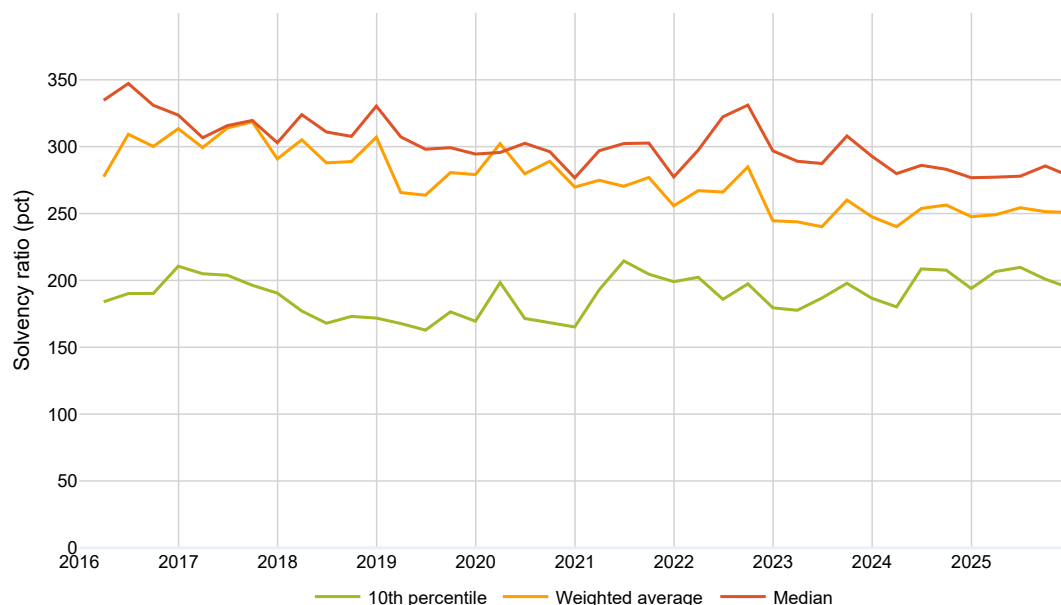
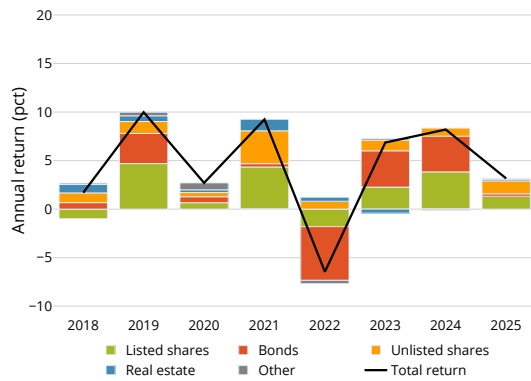


Exhibit 4.27: Solvency ratios in the Danish pension sector 2016–2025. For the calculation of the weighted average solvency coverage, the solvency capital requirements of the companies have been used as weights. Source: Danish Financial Supervisory Authority: The Financial Sector in Figures: Life Insurance Companies and Pension Funds.

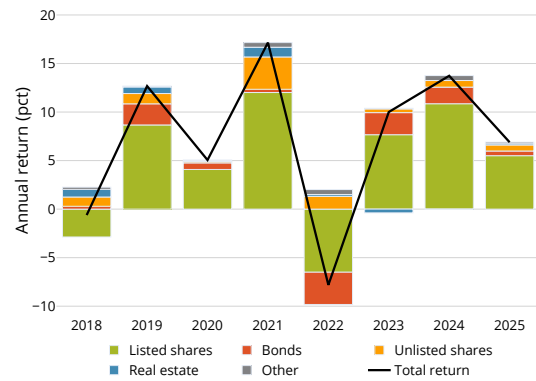
Observation 6: Returns of Danish pension fund products

Danish pension fund products have generated positive, but varying, returns over the last decade, and market-rate products have outperformed average-rate products. Average-rate products have yielded an average return of 4.4 pct in the period 2018–25, ranging from a loss of 6 pct in 2022 to a gain of 10 pct in 2019. Market-rate products have yielded an average return of 7.1 pct from 2018–25. In 2022, market-rate products lost close to 8 pct while they gained 17 pct in 2021. Market-rate products have thus outperformed the average-rate products over the period, but they have also been more volatile. The 2022 drawdown saw losses on both listed equities and bonds, see Exhibit 4.28; the simultaneous gains reported on unlisted shares and other illiquid assets may reflect valuation smoothing rather than genuine outperformance.

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(a) Average-rate products



(b) Market-rate products

Exhibit 4.28: Asset class returns in the Danish pension sector 2018–2025. Source: Danish Financial Supervisory Authority: The Financial Sector in Figures: Life Insurance Companies and Pension Funds.

Some caution is warranted in interpreting the return on private market investments as there is a tendency for smoothing valuations. The Danish Financial Supervisory Authority discussed this problem in a report published in 2020.⁵³

⁵³See Danish Financial Supervisory Authority (2020).

Chapter 5

Architecture of ATP

Key message

The purpose of ATP is to pay guaranteed lifelong pensions for almost all Danes. The design of ATP—including ATP’s role in the Danish pension system, its product, business model, and investment management—serves that objective.

ATP has two objectives. First, the legislation states that the ATP pension is a lifelong, nominally guaranteed pension. Second, the legislation also states that ATP should strive to ensure the real value of pensions. Both objectives have important implications for ATP’s investment strategies.

The ATP Act is ambiguous in relation to the extent of the inflation indexation. ATP’s interpretation leads to very ambitious investment objectives. Legislators should clarify the inflation indexation objective.

ATP’s evolution has been towards greater complexity, culminating in the introduction of the new business model. The result has been an asset structure that while still different has moved in the direction of market-based funds combined with a liability structure that reflects the twin objectives of a nominal guarantee and striving for inflation indexation.

Section 5.1 describes the benefits that ATP delivers, Section 5.2 frames how ATP fits into the pension system and Section 5.3 continues with how ATP is designed as a collective scheme. Section 5.4 discusses the important topics of indexation and bonus payments. Section 5.5 turns to ATP’s balance sheet and the implications for ATP’s investment policy. Section 5.6 summarizes ATP’s governance structure in relation to investments.

5.1 The promise: guaranteed lifelong benefits

Key message

A 66-year-old person who has contributed to ATP through their entire working career can expect to receive a lifelong pension that amounts to DKK 25,400 per year. The expected pension payments for other member age groups primarily depend on the level of interest from the time contributions were paid and the allocated bonus.

5.1.1 Pension payments for different age groups

As of today, a 66-year-old member in ATP upon retirement can expect to receive DKK 25,400 in annual pension payment in today's prices. They will receive a payment as long as they live and can expect that the pension payment will slightly outpace inflation so that the purchasing power afforded by their annual pension is at least preserved. While almost all (99 pct) of the projected pension at retirement is guaranteed, the future uplift in nominal pension payments with realized inflation is not guaranteed and rests upon discretionary bonuses being attributed to their guaranteed pensions as time progresses. The payments to the 66-year-old come from contributions, the implicit interest rate in tariffs, and bonuses. The expected payments for members aged 46 and 26 years are DKK 21,200, and DKK 22,300, respectively.

Exhibit 5.1: Expected pension benefits for different members of ATP.

Key figure	26-year-old	46-year-old	66-year-old
Expected benefit at retirement (in real terms, DKK per year)	22,300	21,200	25,400
Share of expectation in prognosis (pct)	95	40	1
Current guarantees (DKK per year)	1,000	12,800	25,000
Share of current arising from past bonuses (pct)	3	10	37

The younger you are, the less certain the expected payments are and the more they are based on a forecast. This is shown in Exhibit 5.1. The guaranteed pension is much smaller for the young members, because current guarantees only reflect the contributions that have been paid and guaranteed pensions grow with each contribution. Bonuses are also earned along the way, so the share of guaranteed pensions arising from bonus allocations tends to increase with age. The 46-year-old has the lowest expected benefits at retirement since a larger portion of their contributions were made during the low-interest environment between 2008 and 2022. Furthermore, the youngest cohort has had less time to benefit from the positive effects arising from modernizations of ATP's business model, which are expected to increase the expected

returns on ATP's investments.

As the impact of the bonus mechanism has a gradual effect, the balance of guarantees and bonuses is different for different cohorts. We can see this by looking at representative members of different cohorts:

- **26-year-old:** Born in 2000, the first few years of contributions were in the low-interest rate environment prevailing until 2022. Most contributions have purchased 15-year guarantees (not guarantees for life). There has been very little time for bonuses to take effect, so these make up a small proportion of the current guarantees, but with retirement many years away there is some upside expected in terms of bonuses (and other risky returns introduced in the new business model) and future conversions into new 15-year guarantees, when the existing ones run off.
- **46-year-old:** Born in 1980 and approximately halfway through their working life. This member has a mix of different historical guarantees and has experienced different interest rate environments over the last 30 years. Contributions prior to 2015 were paid into older interest rate schemes. From 2015 onwards contributions followed the pattern of the 26-year-old. This member has naturally accrued much larger benefits from bonuses. On the other hand, being closer to retirement, the potential future upside is smaller than for the 26-year-old.
- **66-year-old:** Born in 1960, this member will retire next year. Thanks to the older and high lifelong guarantees of these contributions and significant historical bonuses, a larger proportion of their expected payments come from past bonuses. Their experience through the 21st century has mirrored that of the 46-year-old, but they have benefited more from ongoing bonuses due to their larger sum of accrued benefits.

5.1.2 What has been paid

ATP is now a mature scheme, with the youngest members who joined in 1964 now well into retirement. ATP has existed for more than six decades, and since some of the initial members were close to retirement, ATP has been paying benefits for most of that time. However, as with all pension schemes it took some time for ATP to reach maturity and for benefit payments to outpace contributions, as Exhibit 5.2 shows. Annual benefit payments first exceeded annual contributions in 2007.

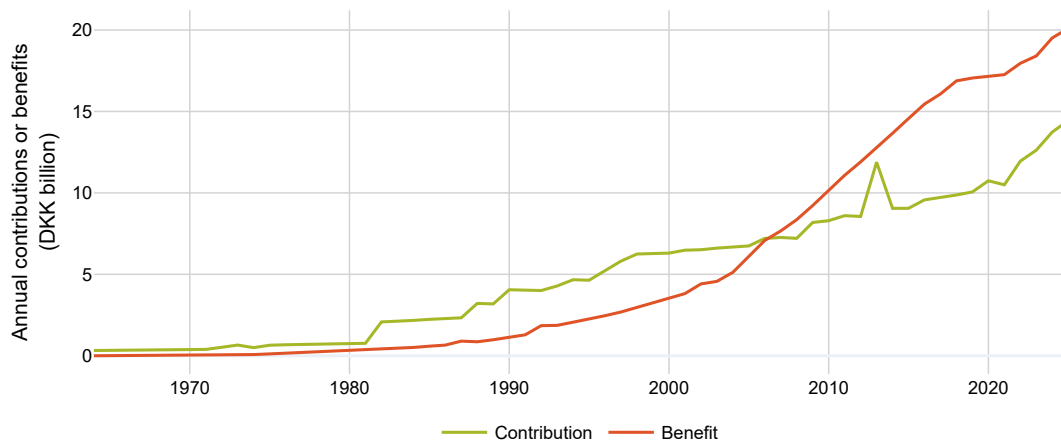


Exhibit 5.2: The development in contributions and benefit payments over time. In January 2013 the savings from the Supplementary Labour Market Pension Scheme for Disability Pensioners were converted into ATP funds. This resulted in DKK 2.8 billion being added to the regular contributions, and explains the peak in 2013.

Benefit payments grew rapidly in the first decades, rising from under DKK 2 million in 1965 to DKK 115 million in 1975 and DKK 589 million in 1985 and crossing DKK 2 billion in 1995. As the scheme matured, the growth in benefit payments slowed, so that over the last decade growth has averaged just over 3 pct per annum. The growth stems in part from growth in number of members and the introduction of Mandatory Pension (OP), which is a state-funded savings scheme introduced in 2020 for recipients of various public transfer incomes. In 2002 and 2025, there were 4,374 and 5,754 million members, respectively.

5.2 ATP's role in the Danish pension system

Key message

ATP is in Pillar 1 of the Danish pension system, providing base coverage to almost all Danes as a supplement to Danish state pension, while Pillars 2 and 3 do not cover all Danes. As opposed to the Danish state pension, ATP is funded. ATP's assets comprise about 15 pct of all funded pension assets. Pensions in ATP are guaranteed for life, whereas the majority of pensions in Pillars 2 and 3 are not guaranteed and systematic changes in longevity are typically paid for by the individual.

The benefits paid by ATP currently make up 7 pct of total benefits paid in Pillars 1–3 and 22 pct of Pillars 1–3, not including the Danish state pension. The Pillar 1 share of total Pillar 1–3 benefits is expected to drop from around 75 pct at present to around 55 pct in 2080 as Pillar 2 schemes mature.

ATP matters most for the less wealthy and low-income brackets. Around 35 pct of pen-

Key message (continued)

sioners rely entirely on ATP and public benefits. Ranking members according to the share of their total pension benefits originating from ATP, the top 30 pct have an ATP share of 12 pct.

The Danish pension system consists of three pillars comprising different benefits and institutions, one of which is ATP. The pillars (which might better be visualized as bricks as they stack up) differ in who is covered, how they are funded, and what they guarantee, as illustrated in Exhibit 5.3.⁵⁴

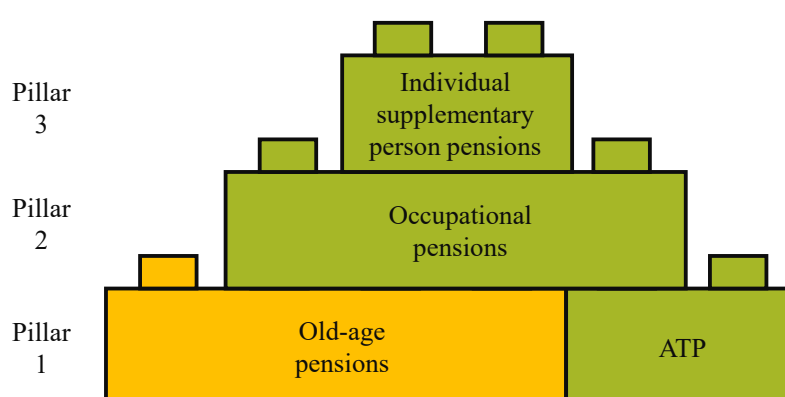


Exhibit 5.3: The three pillars of the Danish Pension system. Each layer illustrates the pillars of the Danish pension system, where the colors represent whether the element is funded (green) or pay-as-you-go (orange). See Exhibit 5.4 for a detailed description of the different elements.

5.2.1 The three pillars of the pension system

The three pillars of the Danish pension system have different features. Exhibit 5.4 summarizes the features. The first pillar consists of public statutory pensions (mandatory), the second pillar covers occupational pensions (quasi-mandatory, earnings-related), and the third, supplementary personal pensions (voluntary, earnings-related).

⁵⁴Pension system taxonomy introduced by the World Bank (see [World Bank \(1994\)](#)).

Exhibit 5.4: Main features of the Danish pension system.

	Danish state pension and supplementary Danish state pensions	ATP	Occupational pension (excluding civil servant pay-as-you-go pensions)	Individual supplementary personal pensions
Pillar	Pillar 1.	Pillar 1.	Pillar 2.	Pillar 3.
Pre-funded	No.	Yes—fully funded via contributions set by law.	Yes—fully funded via contributions set by collective bargaining agreements.	Yes—fully funded via contributions decided by individual.
Coverage	All (Danish state pension). Means tested (Supplementary pensions).	Almost all. Around 95 pct coverage, which is expected to approach 100 pct in the future.	Many. Around 80 pct coverage of working population. Around 55 pct coverage of pensioners.	Few Around 35 pct coverage of working population. Around 40 pct coverage of pensioners. In the future, the expectation is around 75–85 pct will receive a payout from Pillar 2 or 3.
Total savings in scheme(s)	None.	DKK 693 billion.	DKK 3,011 billion (+ estimated civil servant pension of DKK 573 billion).	DKK 1,056 billion.
Pension payment in 2023, averaged as if all Danish state pensioners receive the payment	DKK 151,847	DKK 15,691	DKK 54,228 (Pillar 2 and 3—not possible to separate).	DKK 54,228 (Pillar 2 and 3—not possible to separate).

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Exhibit 5.4 (continued)

	Danish state pension and supplementary Danish state pensions	ATP	Occupational pension (excluding civil servant pay-as-you-go pensions)	Individual supplementary personal pensions
Pension payment in 2023, averaged based on those Danish state pensioners who received the payment		DKK 16,616	DKK 98,219 (Pillar 2 and 3—not possible to separate).	DKK 98,219 (Pillar 2 and 3—not possible to separate).
Guarantee	Public pensions are guaranteed for life, subject to eligibility requirements. Benefits are adjusted with wage inflation.	A lifelong nominal guarantee, with an ambition to preserve purchasing power over time.	For pillar 2 + 3, around 30 pct are guaranteed while the remainder in market rates with some in unguaranteed collective schemes. 80 pct of contributions, to market rate products.	For pillar 2 + 3, around 30 pct are guaranteed while the remainder in market rates with some in unguaranteed collective schemes. 80 pct of contributions, to market rate products.
Lifelong	Yes.	Yes.	A combination of lifelong annuities, a fixed annuity and lump-sum products*. <i>Lifelong annuities:</i> 59 pct of savings and 51 pct of contributions in 2023.	A combination of lifelong annuities, a fixed annuity and lump-sum products*. <i>Lifelong annuities:</i> 17 pct of savings and 26 pct of contributions in 2023.
Mortality risk	No.	No.	Yes, on unit-linked products.	Yes.
Individual deposit	Not applicable.	No, but individual pension rights.	Yes.	Yes.

*: Lifelong annuities in market rate products are slightly different and typically carry less longevity risk for the company, compared to lifelong annuities in traditional occupational pension funds.

ATP is part of Pillar 1 and distinguishes itself by its funding and coverage. ATP was introduced in 1964, long before the expansion of the Danish occupational pensions. It is, as the name suggests, a supplement to the Danish state pension ("Folkepensionen"). Pillar 1 is supposed to provide the basic income needed by retirees. ATP distinguishes itself from the Danish state pension by being fully funded via contributions made through deductions from the income of Danes. It distinguishes itself from Pillar 2 pension funds by being almost universal and having lifelong guarantees. Even people who are not active in the labor market, but receive various forms of government transfers, are covered by ATP.

The three-pillar structure gives distinct and sensible roles to the different pillars. Apart from providing the basic pension income, the first pillar can also be designed as a product for universal needs. Pillar 1 need not be custom made to the individual pensioner and thereby benefits from economies of scale and scope. As a result, the cost of an ATP pension is substantially lower than Pillar 2 or Pillar 3 arrangements (see below). Pillar 2 and Pillar 3 products can then be designed in the knowledge that there is a Pillar 1 below them. They can consider income from Pillar 1 and adjust the risks in their products both to their members generally, and the individual members. Therefore, the pensioner has the benefits of a combination of an inexpensive basic product and a more expensive, more custom-made product. The caveat is that there is a part of the population who do not have the custom-made part of the package (Exhibit 5.5).

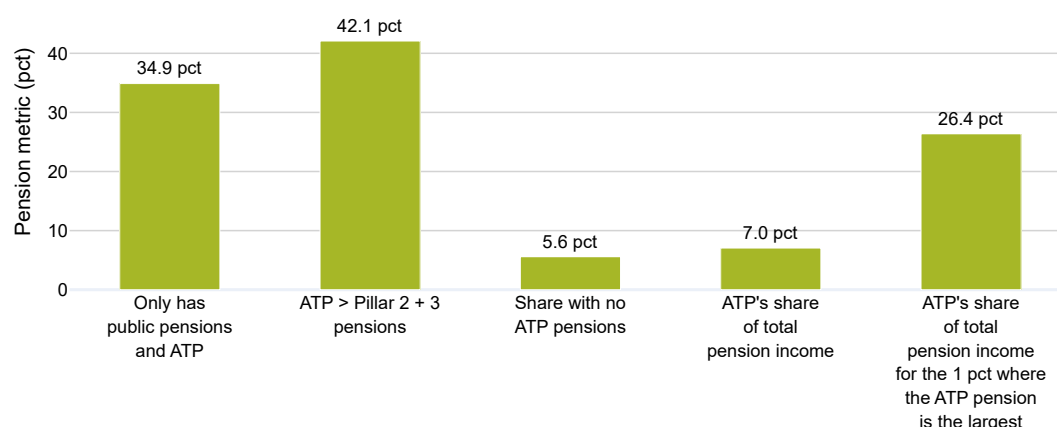


Exhibit 5.5: ATP pension across metrics in 2023 for Danish state pension. The figure shows the impact of the ATP pension across various metrics, that is, how large the ATP pension benefits are compared to Pillar 2 and 3 and how large a share the ATP pension is for the average pensioner, and the pensioners who rely the most on ATP pensions.

Almost all Danes are members of ATP, since the contribution to ATP is mandatory for both salaried employees and for the recipients of many social benefits. The ATP contribution is voluntary for recipients of some of social benefits; for example, recipients of the early retirement scheme ("efterløn"), and the self-employed persons. Some members, who are not covered by

Pillar 2 funds, pay more than the standard contribution. That is for example the case for recipients of unemployment benefits (“arbejdsløshedsdagpenge”) and maternity allowance from Udbetaling Danmark. It is stated by law that their contribution to ATP should be doubled. Nevertheless, there are still Danes who are not contributing to ATP.

5.2.2 ATP's share of pension income

ATP's share of total pension paid to retirees is small but has increased over time. A lifelong member will receive around 7 pct of their pensions from ATP, as shown in Exhibit 5.7. The increase in ATP's share over time is temporary. It reflects the entrance of more women in the labor force before the introduction of broader Pillar 2 pension arrangements. The share of Pillar 1 income—including ATP—is forecasted to decline as occupational pensions mature (see Exhibit 5.6). Today, 35 pct of pensioners have no other pension than the basic pension and the ATP pension (see Exhibit 5.5).

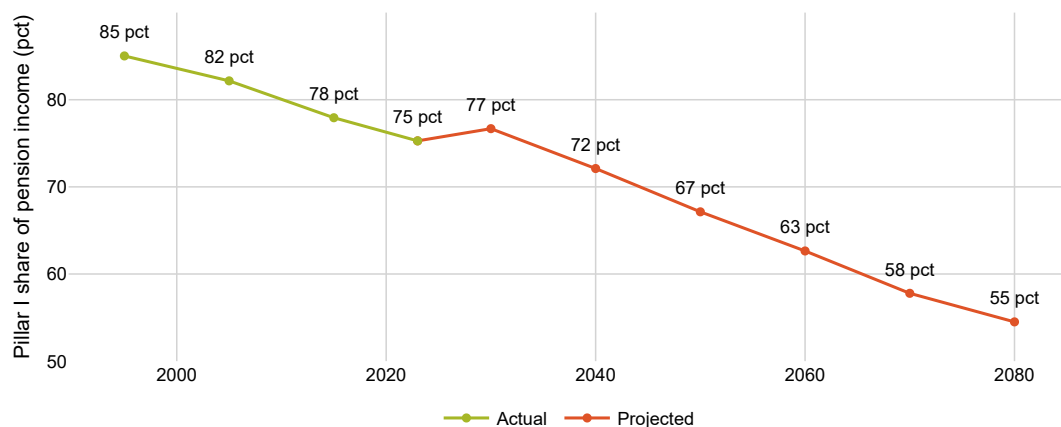


Exhibit 5.6: Pillar 1 share of total pension income. The figure illustrates the share of the pension income which comes from Pillar 1 (public pension and ATP). This is based on DREAM-projections (Danish Research Institute for Economic Analysis and Modelling).

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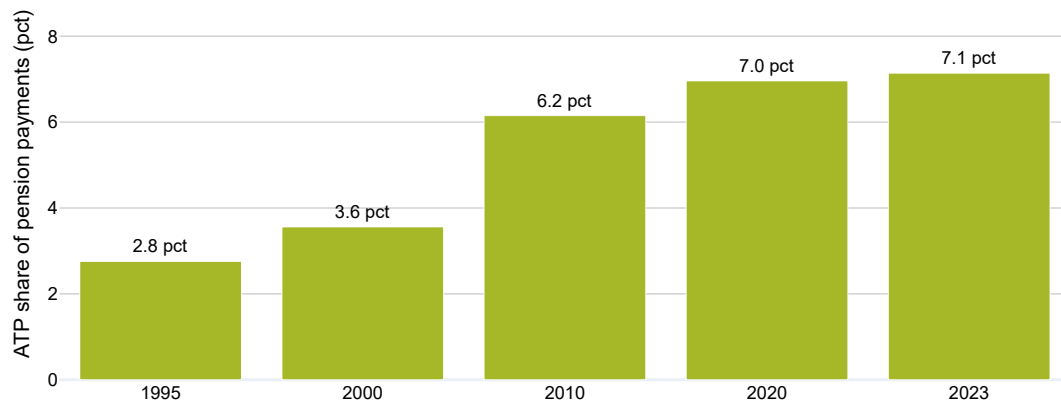


Exhibit 5.7: ATP share of pensions benefits paid from Pillars 1–3.

The ATP contribution has only increased in line with consumer prices, while the Danish state pension has been adjusted by approximately the growth rate of wages. The Supervisory Board of ATP decides the contribution paid into ATP, but it must be approved by ATP's Board of Representatives. The contribution is a fixed nominal amount independent of salary. Historically, the contribution paid in has increased in line with consumer prices, as shown in Exhibit 5.8. The Danish state pension is by law adjusted by the growth rate of wages (with a few exceptions) and subject to discretionary political decisions. Because wage growth typically exceeds price inflation over time, this difference mechanically reduces ATP's relative importance.

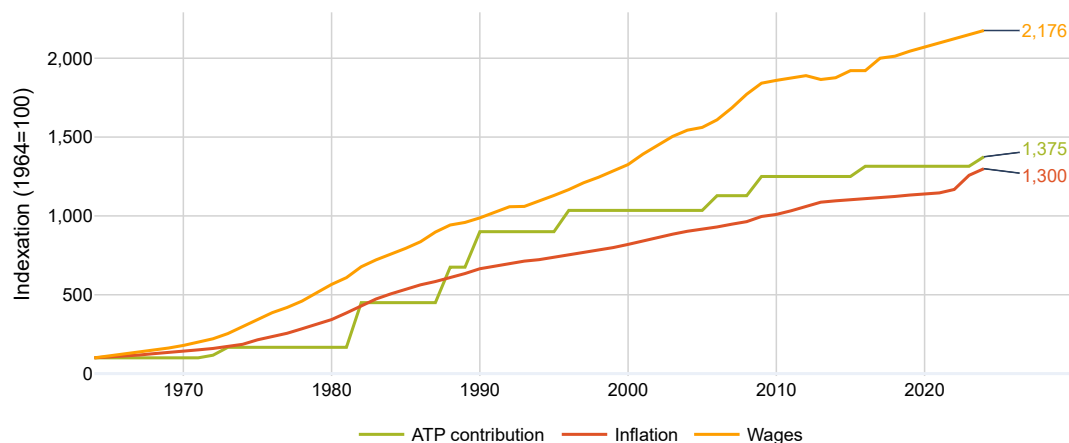


Exhibit 5.8: Historical ATP contribution compared to price and wage inflation. The wage inflation is based on the wage index from the Danish Employers Association (DA). The indices have base value of 100 in 1964.

*The replacement rate of pensioners in the lower income groups is high but declines rapidly for higher income groups.*⁵⁵ For those belonging to the lowest, second-lowest and third-lowest

⁵⁵The replacement rate is defined as the relationship between level of pension payments upon retirement, or later, and the income before retirement.

income deciles, the replacement rates are 112 pct, 76 pct, and 67 pct, respectively. The composition of the Pillar 1 pension is a political choice. It is a so-called pay-as-you-go-system, which has fiscal implications as the Danish state pension is funded out of current receipts of the government, while the ATP pension is funded out of contributions that the pensioner has paid, a so-called prepaid or fully funded pension system.

For pensioners there are potential benefits in having multiple sources of pension income, but ATP's contribution to diversified pension income is limited. For the pensioner, ATP is different from the basic pension because it is funded by the pensioner's own contributions and is only indirectly influenced by political decisions. Further, the ATP pension does not have any restrictions on spending, whereas other public assistance is often restricted to specific expenditures like heating, housing, etc. ATP is also different from Pillar 2 pensions because of its design. Because of its nominal guarantee and relative exposure of the pension benefits to market fluctuations, it is less subject to developments in financial markets. However, the relative size of pension benefits from different sources are such that the diversification benefit of the ATP pension received by pensioners is limited in practice.

The ATP pension is a lifelong pension. The guaranteed pensions are set at the time when contributions are paid in, although they can be adjusted upwards, and they are not reduced because of longer life expectancy. This is different from most Pillar 2 pension arrangements. In Pillar 2 pension arrangements, expected pension payments are increasingly first set at retirement and even at that time, there is no guarantee of pension payments. Increases in life expectancy typically result in reductions in pension payments.

5.3 ATP as a collective pension scheme

Key message

ATP is based on a collective pension fund model, where all members share investment, longevity, and insurance risk. The primary collective funds are placed in a collective pool, the Bonus Potential. The Bonus Potential is the capital buffer of ATP and subsumes all risk-sharing across the collective.

The Collective Buffer, of which the Bonus Potential is by far the largest part, is the difference between the value of the assets and the value of "the pension rights" to the members.⁵⁶

The funds that are not part of the Collective Buffer belong to the members in the form of individual pension rights. The pension right is the calculated annual pension payment

Key message (continued)

that the member has a right to receive in the future. In ATP these are mostly guaranteed. Members are in ATP for life and cannot surrender their policies, meaning that members do not have an individual deposit.

In contrast to ATP, the typical Pillar 2 and 3 fund divides the collective into different subgroups (contribution groups). The funds typically have surrender risk and operate with individual deposits. There are redistribution risks in both business models, but they can be addressed.

The appointed actuary has a responsibility to ensure that the pension basis, including the bonus scheme, is fair. Fairness in ATP differs in some ways from that of the rest of the sector, primarily because the guaranteed annual payments from contributions in a specific year are the same for all members.

5.3.1 The collective

ATP is a collective pension scheme, where financial and insurance risks are shared among all members. They receive the same insurance and pensions coverage, and their participation in the scheme is for life.⁵⁷ The collective provides the individual with:

- A death benefit payable to surviving dependents and spouses (life insurance).
- A lifelong pension, most of which is guaranteed (longevity and financial insurance).
- A right to future bonuses which uplift the value of the lifelong pension (financial upside).

The primary collective funds are placed in a collective pool, the Bonus Potential. It serves the following purposes:

- It is the capital buffer of ATP.
- It subsumes all risk-sharing across the collective.
- It should grow over time such that “bonus” can be paid to provide write-ups to pensions.

While the Bonus Potential serves as a capital buffer, it should not be mistaken as equity requiring a return or profit for shareholders. The Bonus Potential is similar to a beneficiaries' contribution, not a sponsor's contribution.

⁵⁶The Collective buffer is the sum of the Bonus Potential and a smaller liability item called SAP surplus, defined further on.

⁵⁷There are only slight variations in insurance coverage between three types of member groups (ATP Lifelong Pension (ATP), Supplementary Labor Market Pension (SUPP) and Mandatory Pension scheme (OP)), where one member group, ATP, is by far the largest. There is an option for members to defer their pensions up to 10 years.

5.3.2 The individual

Every individual accumulates a growing individual pension right, which corresponds to the guaranteed pension benefit the member will receive in the future, which is funded by the contributions applied to the guarantee. The individual pension right is calculated on a paid-up basis: it represents the pension that would be paid if no further contributions were made from today. Subsequent contributions add further pension rights on top of the paid-up basis. The pension rights at ATP are always annuities.

Payments for death benefits are approximately 2 pct of the individual contributions, before purchasing annuities. The death benefit paid to the individual plays only a minor role. Death benefits do not have any material consequences for the investment strategy because they represent a small, diversifiable source of risk relative to financial assets. For this reason, we do not consider longevity risk in our assessment. However, that is not to say that longevity risk is irrelevant, as systematic changes in mortality assumptions affect the whole balance sheet. In 2018, ATP carried out a major review of its life expectancy model, concluding that members were expected to live longer than originally assumed, and transferred DKK 20 billion to guaranteed pensions.⁵⁸ The increased longevity updates did not change the individual pension right in kroner, but they increased the reserve needed to pay that annuity for life and were therefore borne by the Bonus Potential. (See Section 5.4.5 and Exhibit 5.10.)

There are three types of annuities purchased with the largest portion of contributions:

- **Whole-of-Life annuity:** These are assigned to members 15 years or less from their state retirement age and provide a guaranteed pension payment from retirement age until death.
- **Rolling annuity:** These are assigned to members more than 15 years from retirement age and provide interest rate guarantees for fifteen years at a time, at which point in time they are either converted to a new 15-year interest rate guarantee or converted to a whole of life annuity if the member is less than 15 years from retirement.
- **Variable annuity:** These annuities provide a benefit level which is indexed based on the performance of a risk-seeking portfolio. From fifteen years to retirement onwards these annuities are gradually converted into whole-of-life annuities.

Pension rights are not only earned via contributions but also via bonus allocations from the Bonus Potential. When a contribution is made, or when a bonus is allocated, the increase in the (future) pension right is calculated depending on which of the above annuity types described above receives the allocation. In the case of a contribution, this is done by applying the so-

⁵⁸See <https://www.atp.dk/en/dokument/annual-announcement-financial-statements-2018>

called “tariff,” which converts new contributions into an annuity of future pension payments. When a bonus is allocated, the existing pension rights are increased by a certain percentage.

When the whole-of-life annuity or the rolling annuity is calculated, an interest rate guarantee is issued. The interest rate is based on the observed risk-free interest rate in the market at the point in time the guarantee is given. For the rolling annuity, it is the prevailing 15-year rate. For the whole of life annuity, it is the full zero-coupon interest rate curve and the expected lifespan that decides the guarantee.⁵⁹ For this reason, the tariffs for younger members now reflect interest rates for the next 15 years, but there is no promise on interest rates after this point, only an intention to roll at the prevailing market rate in 15 years. For members close to retirement, contributions are assigned to a lifelong guarantee, into which the pension rights already earned are also gradually converted. When a member retires, all pension rights are fully guaranteed for life.

A common feature of the full pension right in ATP, irrespective of the underlying “annuity” is the longevity insurance. The member can be sure to receive whatever calculated annuity at any point in time, for life. This separates ATP from most pension providers in Pillars 2 and 3.

Individuals do not have the right to surrender their “pension policy.” Individuals do not even have a pensions policy or contract as would be standard among Pillar 2 and 3 providers. The concept of an “individual deposit” also does not exist. In Pillar 2 and 3 schemes, the individual deposit grows over time with contributions, and the returns are allocated to that deposit via a guarantee, a bonus, or a return from a market-rate policy. Technically, the member (or customer) can then surrender their policy and withdraw the deposit. Depending on the scheme, the pension provider may have the right to withhold a fraction of their deposit (the “price protection mechanism”).

5.3.3 Implications for fairness between members

The sharing of insurance and investment risk across the collective implies that redistributions of wealth can occur. The key is to ensure that such redistributions happen fairly, not that they cannot happen. One can categorize redistribution risk into two different types: intergenerational redistributions and intragenerational redistributions. The principle of “fairness,” as is known in the Danish pension sector, also applies for ATP. However, ATP is not bound by the Danish contribution rules, which typically result in the division of the members into homogeneous subgroups, within which fairness follows from the homogeneity of the group itself. In contrast to Pillar 2 and 3 pensions, ATP's Bonus Potential is dedicated to cover longevity and

⁵⁹The rate is calculated on a basket of DKK and EUR interest rate swaps as well as DK and German government bonds. When the full curve is used, a smoothing mechanism from 30 years and onwards out to a fixed long-term rate is used. This is further described in Sections 5.5.2 and 6.2.

index the pension rights. Therefore, the contribution principle does not apply to ATP.

Intergenerational redistribution risk is the risk of one generation systematically subsidizing another to their own detriment. It could happen if a substantial portion of the wealth of a retiring generation is “left on the table” when they die. The opposite could potentially happen if the young generation pays an excessive fraction of their contributions to the Bonus Potential, compared to the Bonus Potential's relative size of the balance sheet. At ATP the interest rate guarantee applied to any contribution is the prevailing market rate at the time the contribution is made. One can be “lucky” and receive a high rate or vice versa—but this is a function of prevailing market conditions. The fraction of contributions entering the collective is constant, that is invariant of time and market conditions. This is a large step towards obtaining fairness across generations.⁶⁰

It is sometimes stated that the contribution of 25 pct to the Bonus Potential (typically around 20 pct) creates a redistribution from the young to the old. However, this is inaccurate, as it overlooks the fact that the Bonus Potential is not fully paid out. ATP's Actuarial Department assesses intergenerational redistribution risk. The bonus allocation, including the retiree bonus, can be used to balance pensions across generations.

Intragenerational redistribution risk is the risk of redistributions between various groups within a generation. Each individual dies at a different age and hence receives a different value from a whole of life annuity—even if the individuals are exactly the same age. This is the nature of insurance and there is nothing inherently unfair about this. It creates additional value for individuals up front in that they do not have to build buffer funds to protect themselves in case they live longer. However, if different subgroups have different underlying life expectancies, such intragenerational redistributions can become unfair. It is possible to identify such subgroups by looking at specific defining characteristics. For example, it is well documented that women live longer than men, and that smokers die younger than non-smokers. All these subgroups are covered by ATP, and all receive the same tariff. This can be considered an implicit unfairness in ATP's product. However, it is not always possible to identify and price these effects on an individual level (indeed it is currently illegal to use an individual's sex as a factor in insurance pricing).

⁶⁰This lessens the need for so-called interest rate contributions groups. In ATP, there is no separation into contribution groups, as otherwise seen in Pillar 2 and 3 schemes, where interest rate guarantees are typically constant. This has the implication that the fraction of contributions supporting the collective, via the so-called individual Bonus Potential, is not invariant of time and market conditions. In order to remedy this problem in Pillar 2 and 3 funds, it is necessary to separate policyholders into the various levels of interest rate guarantees.

5.4 Indexation and bonus

Key message

Bonuses serve the purpose of providing write-ups to pension rights. Bonuses redistribute means from the collective to the individual and are irreversible. When a bonus is paid out, the collective buffer shrinks, and with it so does ATP's risk capacity.

The bonus ratio, which is the Bonus Potential relative to the value of the pension rights, is around 20 pct in ATP. The higher the bonus ratio, the higher the pension fund's solvency, and all other things being equal, the greater ATP's capacity to take risk and to pay a bonus.

Since 2002, the ATP Act states that ATP "should strive towards a long-term bonus policy, that preserves the real value of pensions." Pension rights are based mainly on a nominal interest rate guarantee, which includes compensation for expected (average) inflation and a real rate. Writing up the pension rights with realized inflation means compensating for inflation twice—once for expected inflation in the nominal guarantee and another time for realized inflation as pension payments are indexed, on top of the real interest rate.

It is not possible to devise an investment strategy that delivers twice the inflation and the real rate in all scenarios. When the bonus ratio is around 20 pct, the return on the Bonus Potential needs to be large in order to deliver a write-up of pension rights with inflation. This constitutes a major challenge and raises questions regarding whether the ambition is too high compared to the risk ATP should run in its Risk-seeking Portfolios. Under the current business model and risk target, ATP expects, over a 10-year period, to write up pension rights with realized inflation with a probability of around 60 pct.

5.4.1 The dual mandate: nominal guarantee and striving for real value preservation

The ATP Act specifies two different objectives in relation to protection against inflation:

- The long-run bonus policy should strive to ensure the real value of the pensions ("ATP should strive for a long-term bonus policy that secures the real value of the pensions").
- ATP shall aim for investments to preserve their real value ("The objective for investment of the assets shall be to maintain their real value").

The two objectives are not the same. The former is very hard to obtain with certainty; the latter is easier. The former is interpreted as writing up the guarantees with a nominal rate that already incorporates expected inflation. The latter only requires the total wealth of ATP to

grow, on average, at a rate at least equal to inflation. ATP interprets the former as striving to write up the guarantees with inflation. This is ambitious, as the guarantees already incorporate expected inflation. However, the use of the word “strive” in the (Danish version of the) ATP Act shows that inflation indexation is not an absolute commitment. Hence, it must be weighed against other risks, such as the risk of becoming insolvent.

The ambiguity on how to interpret the objective to protect against inflation justifies digging deeper to understand the underlying objectives. It is a reasonable objective that pensioners should not expect to lose money in real terms when they pay into a pension system. They should also expect some real return as they can achieve that by other forms of investing.⁶¹ Another reasonable objective is that when people retire, they can count on their pensions to be adjusted for inflation. A more debatable objective is whether members should be able to count on inflation indexation of their pension rights before retirement. The younger you are, the more you can adjust your savings behavior and income. The wording “strive to ensure the real value of pensions” also leaves some room for interpretation. Striving earlier and striving more results in a higher shadow price of the guarantees. Needless to say, everybody, including the young, should benefit from the Bonus Potential.

5.4.2 The double counting of inflation protection

Expected inflation is already addressed through the way the tariffs are set. By using a risk-free rate to calculate the tariffs, the tariffs include a nominal return to the contributions. Exhibit 5.9 shows that a nominal return can be split into a real return component (the real short rate and a real term premium) and an inflation component (expected inflation and an inflation risk premium). Thus, there is a real return on the contributions reflecting the real return component in the risk-free interest rate. In addition, the tariffs already include an inflation term. Therefore, there is no expected real loss on the contributions paid in.

The objective pursued by ATP thereby delivers not only one inflation adjustment of the contributions, but two inflation adjustments plus the real return on a risk-free bond. Exhibit 5.9 illustrates that, when a bonus is added onto the guarantee, inflation is included twice: once when expected inflation is built into the nominal guaranteed yield and another time for realized inflation, which is what the bonus seeks to index.

⁶¹This is not as unambitious as it may look at first sight. To the extent that mortality rates decline more than expected, as they have done historically, ATP must set aside part of the return to cover this risk. There are also administration costs.

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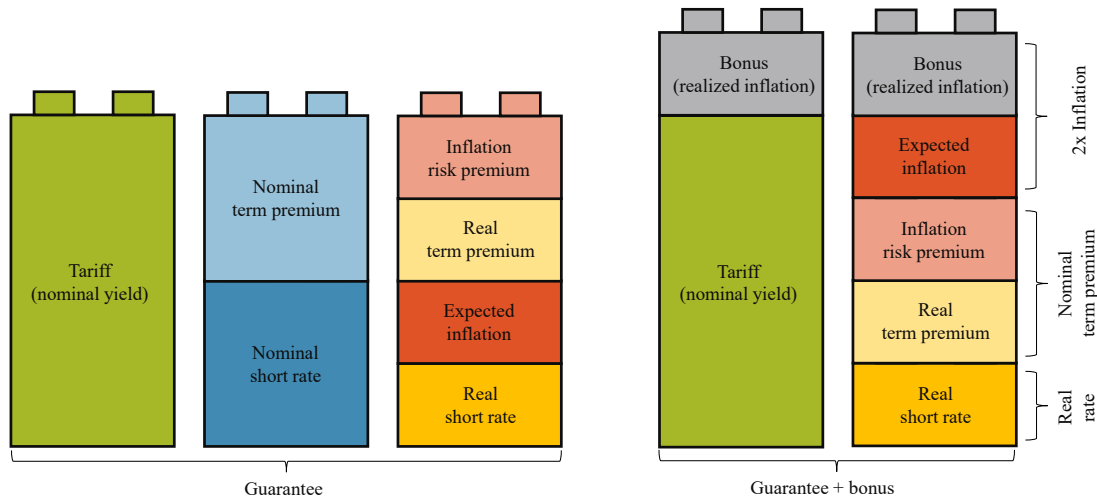


Exhibit 5.9: The tariff already includes an inflation component. The exhibit illustrates the different components of the guarantee and the bonus. The guarantee (or the tariff rate) can be decomposed into the short rate and term premium, both of which can be decomposed further into real and inflation-related components. When bonus is viewed in addition to the tariff rate, there are two inflation adjustments—the expected inflation component already in the tariff and the realized inflation component that the bonus seeks to index.

ATP's current interpretation of the objectives in the ATP Act—to give both a nominal guarantee and strive for indexation from bonus—is a very ambitious objective that gives rise to significant reputational risks. The combination of three elements brings tension to the business models. The pension fund has:

- Issued nominal guarantees, which need to be honored *with high certainty*.
- A Bonus Potential, which is “only” *roughly 20 pct of the guarantees*.
- Issued a bonus option, that is, *bonus can never be negative*.

Overly ambitious objectives can stretch the organization to potentially take large risks. Chapter 6 expands on the implications of the inflation indexation.

5.4.3 Founders' original intent

It is noteworthy that the founders of ATP in 1963 decided not to index ATP's pensions. They did mention the ability to increase pensions, if there was a sufficient surplus in the fund. And that such increases could take into consideration inflation, along with the economic conditions of the nation and the populace. The founders' report explicitly stated:

“An automatic adjustment clause is not proposed. It is emphasized that the funds should be placed with the ambition to not only provide adequate protection and the highest possible return, but also preservation of the real value of the funds, pursuant to paragraph 21, section 1 of the proposed act. It is furthermore the committee's view that, at the discretion of the governing body of the pension fund, the question of updating the pensions at appropriate intervals pursuant to paragraph 14, section 2 and 3 of the proposed act can be raised. Accordingly, it can in part be considered that, to the extent that the funds income exceeds the calculated pension expenditures, within the limits of such surplus to raise pension benefits under due consideration to development in prices as well as the development in the country's and the populations economic conditions and in part be considered to change the contributions to the pension fund”⁶²

5.4.4 The premises for bonus

Bonuses are allocated to the guarantee from the Bonus Potential. The bonus is allocated yearly, it is non-negative and irreversible. It increases the guarantee and decreases the Bonus Potential. Although formally discretionary, the bonus allocation serves important objectives:

- ***Inflation compensation:*** Bonus allocations should strive towards preserving the real value of the guaranteed pensions.
- ***Fairness:*** Bonus allocation should strive towards fairness between members.

Furthermore, ATP is obliged to ensure that the solidity of ATP is maintained. Bonuses should not be so large that they jeopardize ATP's capacity to make sufficiently risky investments or threaten solvency. These aspects should be considered in conjunction and hence the final bonus decision should represent a sensible balance.

ATP can differentiate bonuses. The general bonus applies to all members, while the retiree bonus only applies to pensioners. The latter is applied less frequently, especially in periods when ATP cannot give a general bonus to all members. Thus, ATP has the possibility to strive towards preserving the real value of the guaranteed pensions for only the pensioners, in periods where ATP does not have the ability to do so for all members.

A bonus allocation reduces ATP's risk capacity. Pension rights and hence the value of the Guaranteed Benefits increase, while the value of the free collective buffer, the Bonus Potential,

⁶²The text in Danish: “Der foreslås ikke en automatisk reguleringsbestemmelse. Man har lagt vægt på, at der ved fondsmidlernes placering tilstræbes ikke blot en betryggende sikkerhed og den højst mulige forrentning, men også en opretholdelse af midlernes realværdi, jfr. lovforslagets § 21, stk. 1. Det er i øvrigt udvalgets opfattelse, at det bør overlades ordningens ledelse med passende mellemrum at optage til overvejelse spørgsmålet om en ajourføring af pensionerne, jfr. lovforslagets § 14, stk. 2 og 3. Der kan herved dels blive tale om i det omfang ordningens indtægter overstiger de beregnede pensionsudgifter, inden for rammen af et sådant overskud at foretage en forhøjelse af pensionerne under hensyntagen til den skete prisudvikling og udviklingen i landets og befolkningens økonomiske forhold, dels kan der blive tale om at ændre bidragene til selve ordningen.”

is reduced. It constitutes an implicit de-risking of investments since means from the risky assets are directed towards the risk-free hedge portfolio.

5.4.5 Historical bonus distributions versus realized inflation

Historically, the bonus distributions have not managed to keep up with inflation. From 2008 to 2026, the cumulative inflation indexation amounted to 36 pct, whereas the bonus distributions to old-age and non-old-age pensioners have been 18 pct and 9 pct, respectively, as shown in Exhibit 5.10. For old-age pensioners, the write-ups have undershot inflation by 18 pct, demonstrating that historically it has been a challenge to write up guaranteed pensions with inflation. The chart also shows that the undershooting is driven very much by the post-COVID inflation shock.

Part of the Bonus Potential has been used to finance the experienced increases in life expectancy and without those, a substantially higher bonus could have been allocated to compensate for inflation increases. During the considered period, the Guaranteed Benefits have been written up by roughly 11–12 pct due to increased life expectancy of ATP's members. Had life expectancy not increased more than expected, ATP could have spent the money on increased bonuses. The graph shows a fictional calculation of the write-ups to bonuses, if all longevity “write-ups” had been spent on general bonuses to all members. Here, pensioners and non-pensioners land at 30 pct and 20 pct, respectively. This still undershoots cumulative inflation indexation but to a lesser degree.

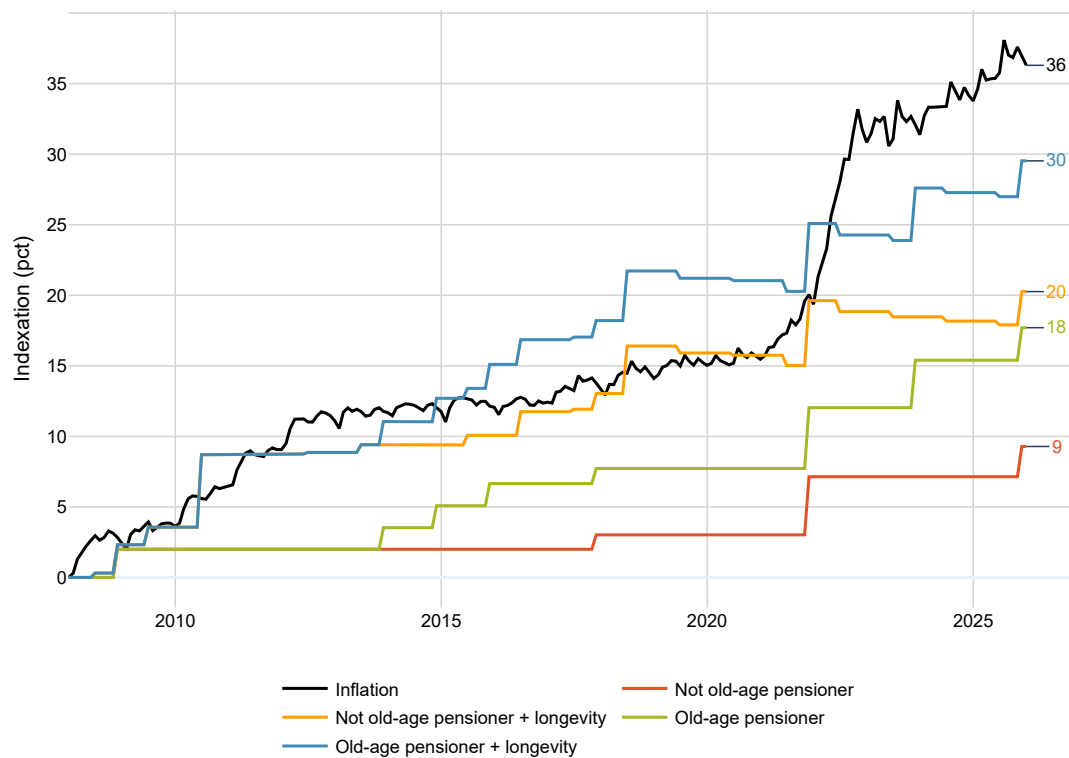


Exhibit 5.10: Historical Bonus distributions and inflation. The figure illustrates the historical bonus distribution to all members who are old-age-pensioners and members who are not. During the period ATP has made significant additional provisions because of longer life expectancy. The figure also contains two additional series, where the same amount was allocated as general bonus rather than longevity coverage. Finally, the figure compares the two bonus distributions to realized inflation (Danish HICP) over the period. The starting point is 2008, where tariffing on contributions was changed to a market-based interest rate.

5.4.6 Ability to pay bonuses

When a bonus is allocated to the guarantees, the Bonus Potential drops with the exact same amount in DKK as the pension liabilities are increased in DKK. The AuM does not change. Exhibit 5.11 illustrates this point. The bonus distribution in 2021 of around DKK 31 billion decreased the Bonus Potential, and increased the pension liabilities with the same amount, equivalent to around 4 pct.

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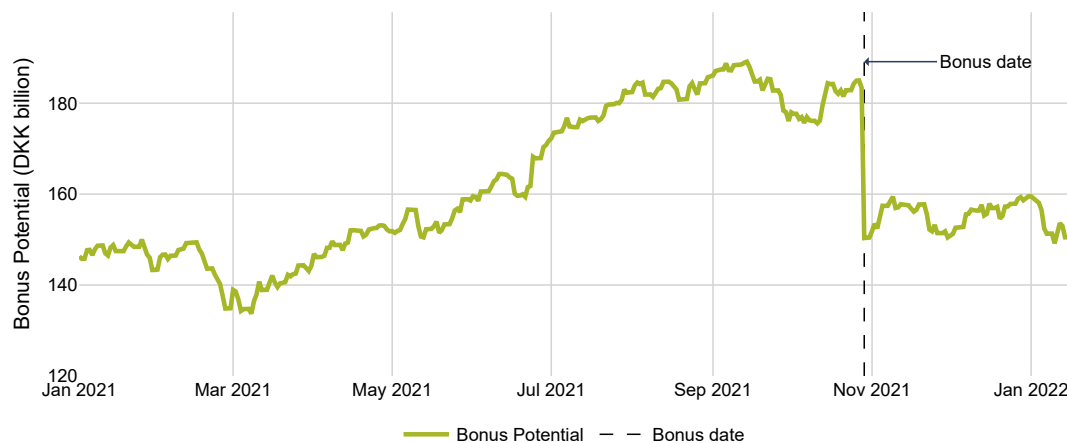


Exhibit 5.11: Impact of bonus on the Bonus Potential. The graph illustrates ATP's Bonus Potential in 2021, where a bonus allocation of 4 pct was given in October 2021. The decision to allocate bonus transfer funds from the Bonus Potential to the pension liabilities, which is shown by the drop in Bonus Potential in late October 2021.

One measure of ATP's capacity to pay bonuses, and hence to carry investment risk, is the "bonus ratio," which is the value of the Bonus Potential relative to the value of the pension rights. This ratio expresses ATP's ability at any point in time to write up the pensions, and thus it is also called the *bonus ability*. The *funding ratio* is defined as 1 plus the bonus ratio. To facilitate a stable risk budget in the Investment Portfolio and to ensure stability in ATP's solvency, the bonus ratio should be kept relatively stable.

The bonus ratio under ATP's investment strategy has been relatively stable as opposed to what it would have been under a 60-40 equity-bond strategy. Exhibit 5.12 reports the historical bonus ratio of ATP from 2002 to 2025. The financial year 2002 is the first year where all items on the balance sheet were recorded at market value and a more formal focus on maintaining stable funding ratios was established. The bonus ratio has been relatively stable throughout the period, although there was a large drop in 2002, where hedging of liabilities was below 100 pct as the risk management approach to investments had not fully matured. The exhibit also shows how the bonus ratio would have evolved under an alternative 60-40 global equity-bond portfolio. For the alternative strategy, everything else is assumed equal, including contributions received, benefits paid, and bonus strategy. The alternative strategy does not hedge liabilities and exhibits a more volatile bonus ratio. In particular, ATP would have been severely underfunded from the beginning of the Global Financial Crisis and only achieved a recovery during the last few years, where interest rates have risen substantially. As will be shown later, the fact that ATP has fully hedged its liabilities has been quite beneficial for a major part of the time period considered.

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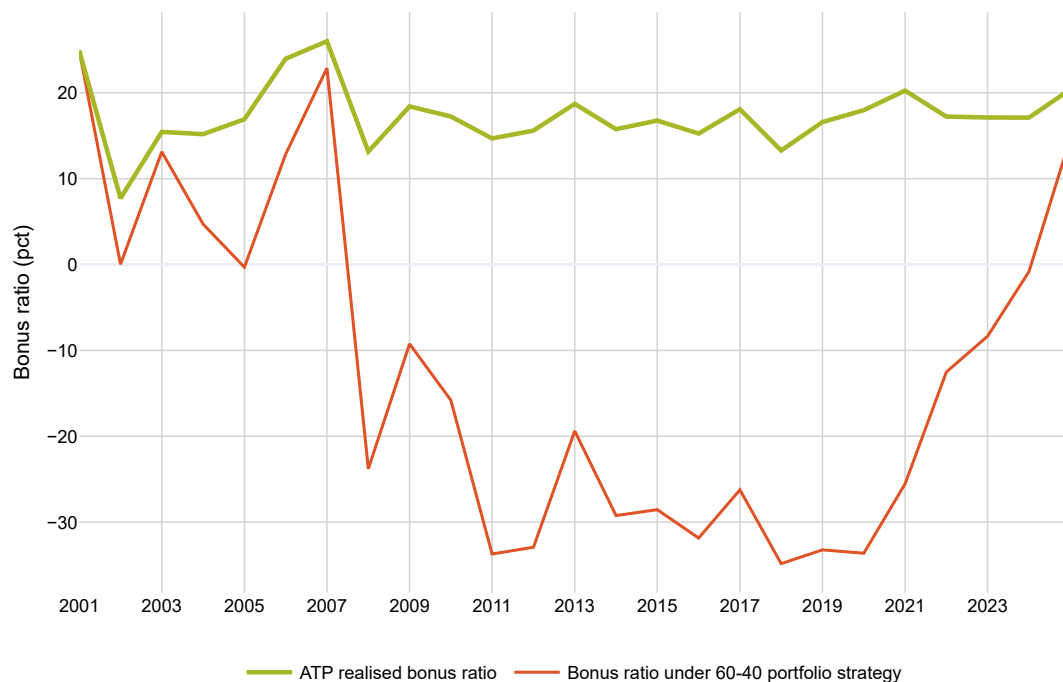


Exhibit 5.12: Historical bonus ratio of ATP. The figure illustrates the historical development in ATP's bonus ratio starting from 2002 to 2024 along with how the bonus ratio would have evolved if the returns would have followed a 60-40 strategy—the full AuM consisting of MSCI ACWI, currency hedged, and global bonds (Bloomberg Global Treasury Index, currency hedged).

5.4.7 ATP pensions in a wider pension context

The ATP pension and other sources of pension income should complement each other. Pillar 2 and 3 pensions are increasingly subject to movements in financial markets. However, as retirement approaches, most Pillar 2 pensions aim for greater stability. In the pension years, Pillar 2 and 3 pensions payments typically decline, often in nominal terms. Some Pillar 2 and 3 pensions have a limited number of years they pay out, typically ten years. The greater stability in and the lifelong payment of ATP pensions therefore complement the design of Pillar 2 and 3 pensions.

*The Danish Financial Supervisory Authority (DFSA) published a discussion paper in 2017 entitled “When guarantees disappear,” which recommended that pension funds define their investment policies based on the pensions they want to deliver.*⁶³ The background for the paper was the shift in Pillar 2 pensions from guaranteed return products to non-guaranteed products (defined contribution products).⁶⁴ In practice, defined contribution funds could take almost

⁶³Danish Financial Supervisory Authority (2017).

⁶⁴The shift to non-guaranteed products occurred because the guarantees had become very expensive to maintain as interest rates fell. The pension funds with guaranteed return products had to invest in bonds and swaps with low returns to hedge their obligations. In doing so, the funds gave up the possibility to earn higher returns on other investments such as equities—an issue which we discuss in more detail in Section 5.5 and Chapter 6. By shifting from guaranteed return products to non-guaranteed products, there were fewer constraints on investments, and pension funds could invest more in equities and alternative assets. However, this made pensioners bear higher risks. Solvency II is the main tool used by the DFSA to contain risk-taking in pension funds, but it was not effective

unlimited risks. Since pension funds should not take unlimited risks on behalf of the pensioners, the DFSA recommended that the board of pension funds link their investment policies to the kind of pension that they wanted to deliver to their pensioners and the risk to that pension.

ATP has been ahead of most other pension funds in this area by focusing on the value of the pensions provided, despite ATP being a partially guaranteed product. Pensions are about contributing to the welfare of people at a time of their life when they have few other sources of income. Pensions should not be a narrow asset management product that focuses on maximizing the size of the assets and disregards the risk to pension income.

The less ambitious ATP's objectives are, the less of a role ATP will have relative to other pension income, unless contributions are increased. There are several possibilities for less ambitious objectives that both make sense and could fall within the ATP Act (Section 5.4.1). A less ambitious objective would lower the risk that ATP cannot deliver the guaranteed pensions but comes at the cost of lower expected pensions. This would further reduce ATP's relative importance and its role as a source of diversification. ATP's role in diversifying shocks to other sources of pension income is already limited. The main driver, as earlier mentioned, is that ATP contributions are not adjusted with wages (Section 5.2.2 and Exhibit 5.8). If ATP earns a lower return, the decline in ATP's relative importance will accelerate. Adjusting contributions in line with wage inflation instead of consumer prices would require additional annual contributions of approximately of DKK 80 each year. Larger increases in ATP contributions could both increase ATP's role and allow ATP to pursue a less ambitious inflation objective with less reputational risk. However, it falls outside our mandate to make specific recommendations about contributions. Sections 6 and 7 expand on the implications for ATP's risk-taking of the inflation indexation objective.

5.5 ATP's balance sheet and flows

Key message

ATP's architecture can be understood as a set of liability elements, each of which has a representative portfolio on the asset side, which serves the purpose of "covering" the specific liability item. ATP's obligations to members are recorded as liabilities on its balance sheet. Assets are held in portfolios that cover specific liabilities.

ATP's architecture can be understood as a set of liability elements, each of which has a rep-

in restraining funds from taking excessive risk in defined benefit products. Solvency II works by specifying own funds requirements that ensure that the risks undertaken do not endanger guarantees. With the move to non-guaranteed products, pensioners were no longer guaranteed a return on their savings—all risk was transferred to the pensioner and there was no risk to the fund. Thus, Solvency II proved ineffective in limiting risks to the pensioners.

representative portfolio on the asset side, which serves the purpose of “covering” the specific liability item. In this section, we outline the major features of ATP's balance sheet and the flows between elements in the balance sheet.

ATP's obligations to members are recorded as liabilities on its balance sheet. These liabilities reflect:

1. The guaranteed lifelong pensions accrued from contributions paid.
2. Elements linked to market exposure.
3. The Bonus Potential that may increase pensions over time.

For members, these are the most important parts of ATP's balance sheet. They represent the pensions they have earned or possibly will earn in the future.

Assets are held in portfolios that cover specific liabilities. Each major liability component is supported by a corresponding portfolio. The structure separates:

1. A portfolio that hedges the nominal guarantee.
2. Portfolios that support market-linked elements and assets that support long-term risk-taking capacity.
3. A portfolio that generates return on the Bonus Potential.

The portfolios 1–3 correspond to the three liability items 1–3 on ATP's balance sheet. The assignment of specific assets to specific liabilities is consistent with finance theory (Section 4.1), where different liabilities and risks are separated and managed according to their economic function.

5.5.1 Contributions and pension payments: where do member contributions go?

Key message

Each member's contribution is split into the following main components:

- *80 pct into individual pensions rights, which apply for the entire lifetime—that is, life-annuities.* This contribution is further split depending on the number of years to retirement:
 - Until 15 years before retirement:
 - * 60 pct into rolling 15-year interest rate guarantee (“rolling annuity”).

Key message (continued)

- * 20 pct into market-risk product ("variable annuity").
- Less than 15 years to retirement:
 - * 80 pct into lifelong guarantee ("whole-of-life annuity").
- ***20 pct into the collective Bonus Potential, which has full risk capacity and carries no pension rights.***

At 15 years before retirement all monies allocated to individual pensions rights are gradually converted into a lifelong guarantee. At retirement, all pension rights become a lifelong guarantee.

During the whole lifetime of the member, the Bonus Potential will provide write-ups to pension rights and cover longevity risk.

Contributions

Contributions from members are allocated across three buckets, and the allocation depends on the member's age. This is illustrated in Exhibit [5.13](#).

For members with more than 15 years to retirement:

– 60 pct goes to the rolling annuity.

This portion accrues to a nominally guaranteed lifelong annuity. The accumulation reflects the nominal interest rate prevailing at the time of contribution, which contains both a real rate component and an expected inflation component. Technically, the contribution accrues to an annuity beginning 15 years in the future. Once the 15-year horizon is reached, the accumulated amount is rolled forward into a new annuity with a new 15-year horizon.

– 20 pct of the contribution is allocated to the annuity with market exposure.

This bucket is exposed to market returns and contributes to pension payments depending on realized investment outcomes.

– 20 pct of the contribution is allocated to the Bonus Potential.

For members within 15 years of retirement:

– 80 pct of contributions are allocated to the whole-of-life annuity.

This portion accrues to a nominally guaranteed lifelong annuity. The accumulation reflects

the nominal interest rate prevailing at the time of contribution, which contains both a real rate component and an expected inflation component.

– 20 pct of the contribution is allocated to the Bonus Potential.

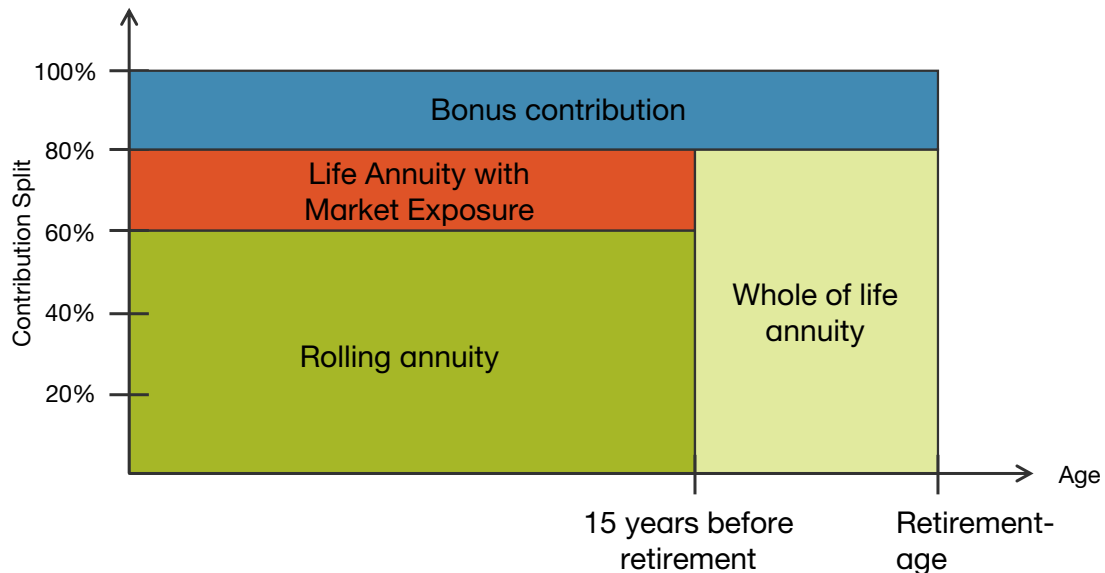


Exhibit 5.13: The ATP product—distribution of contributions as a function of age.

Flows between types of annuities and the Bonus Potential

Once contributions have been made and returns in the portfolios have been generated, there are flows between those items. These flows are highlighted in Exhibit 5.14. All the reserves in the annuity with market exposure and the rolling annuity are gradually converted to the whole-of-life annuity over a 15-year period. For every member, a bonus allocation from the Bonus Potential will be allocated pro-rata to the respective annuities that comprise their pension rights. Also, the Bonus Potential covers changes in life expectancy of the members. For example, if an increase in life expectancy happens, the pension right in DKK does not change from the point of view of the member. However, they will receive that pension payment for a longer time and the reservation in the Guaranteed Benefits will increase. This increase is taken out of the Bonus Potential.

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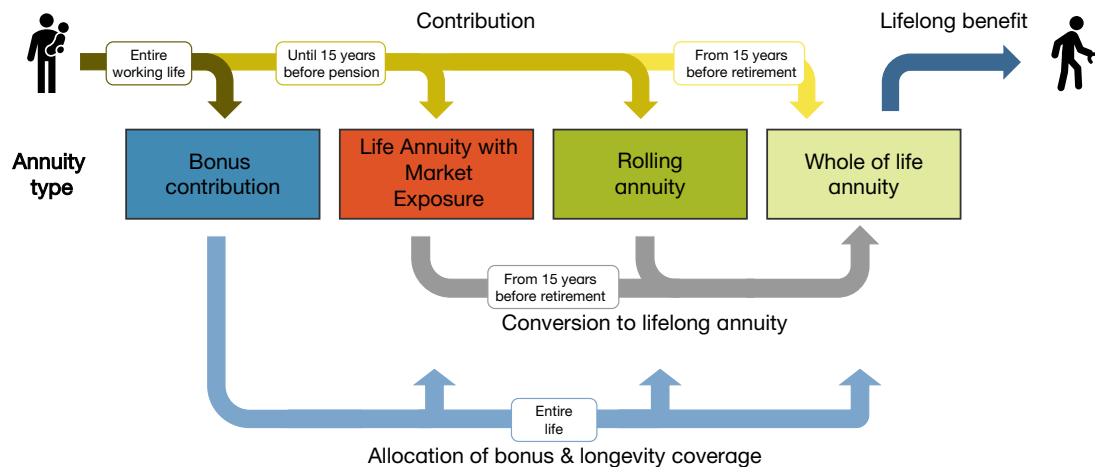


Exhibit 5.14: ATP product—contributions, payments and internal conversions and flows.

5.5.2 Guaranteed Benefits and their market value

Key message

The portion of the pension rights that is guaranteed comprises the backbone of ATP's current pension liabilities. The sum of those pension rights across all members, corrected for expected mortality, gives rise to an expected liability cash flow. If expected mortality or other actuarial assumptions change, the shape and size of the cash flow will change. For every contribution made, or bonus paid, the shape and size of the cash flow will also change. The present value of the cash flow is called the Guaranteed Benefits. The Guaranteed Benefits are marked to market daily using a risk-free discounting curve. The current discount curve contains two main elements:

- A term structure of "risk-free" interest rates up to 30 years maturity.
- An extrapolation mechanism from 30 years and outwards.

*All historical bonuses and contributions paid into to the rolling annuity and the whole-of-life annuity give rise to a benefit cash flow, which creates the fundamental liability item, the **Guaranteed Benefits**. Whenever a payment, as illustrated in Exhibit 5.15, enters these annuities, the guaranteed cash flow for the specific member is changed. As seen from the point of view of ATP, this is the *expected* cash flow, since ATP does not know when the specific member will die. However, due to the large number of members, this uncertainty is greatly reduced and the expected cash flow will thus be realized with a high degree of certainty, given the assumptions of life expectancy are correct. The sum of all expected cash flows gives rise to a total guaranteed cash flow that ATP must be able to meet.*

*The reservation for the guaranteed cash flow, "the **Guaranteed Benefits**," is fully marked to market on a daily basis using a risk-free zero-coupon discount curve based on observed mar-*

ket interest rates. The principles behind the discounting curve are set by ATP's Supervisory Board to ensure consistency, robustness and alignment with ATP's business model and legal framework. Amongst other things, the curve should be:

- Risk-free.
- Reflect ATP's long-term liabilities, which are denominated in DKK.
- Hedgeable in the market using liquid financial assets and instruments.

To this end, ATP's discounting yield curve is based on a weighted mix of high quality, highly liquid instruments with weights:⁶⁵

- Danish government bonds: 22.5 pct.
- German government bonds: 22.5 pct.
- DKK-denominated interest rate swaps: 12.5 pct.
- EUR-denominated interest rate swaps: 42.5 pct.

Danish assets are preferred due to liabilities being in DKK, but euro assets are included due to market size and liquidity.

The curve is divided into two segments:

- Up to 30 years: The curve is estimated directly from market data as mentioned above.
- Beyond 30 years: The curve is extrapolated by assuming a long-term constant forward rate.

This follows the logic applied in the Danish pension sector, which uses a discounting curve defined by the Solvency II framework. The longer part of the curve is determined by an extrapolation from the "first smoothing point" and out to a long-term forward rate, akin to the "ultimate forward rate" used under Solvency II. The rate is currently 3 pct before PAL tax, and it is set manually at ATP, reviewed annually, using primarily historical data analysis and Supervisory Board approval.

The design of the discount curve has important financial implications:

- There is interest rate risk in the liabilities as discussed in Section 4.1. When interest rates change, the value of Guaranteed Benefits change.

⁶⁵Actual weights evolve slightly over time due to consideration regarding market liquidity.

- The implicit expected growth in the value of the guaranteed liabilities is embedded in the prevalent discount structure. When interest rates are high, the value of the liabilities decreases, and vice versa. This in turn impacts the required return on investments needed to honor the liabilities.

The extrapolation mechanism moves the discount rate away from the market rates at the long end of the curve. Therefore, the implied required return on investments differs from what can be obtained from the risk-free assets available in markets. This difference can be negative or positive, and its consequences are discussed in Section 6.4. The rates used to discount the expected cash flows are after PAL tax, since all returns on the asset side that can be used to honor the cash flows are susceptible to PAL taxation. The discount curve and the cash flows underlying the Guaranteed Benefits are depicted in Exhibit 5.15. The interest rate duration of the Guaranteed Benefits is around 13.5 years.

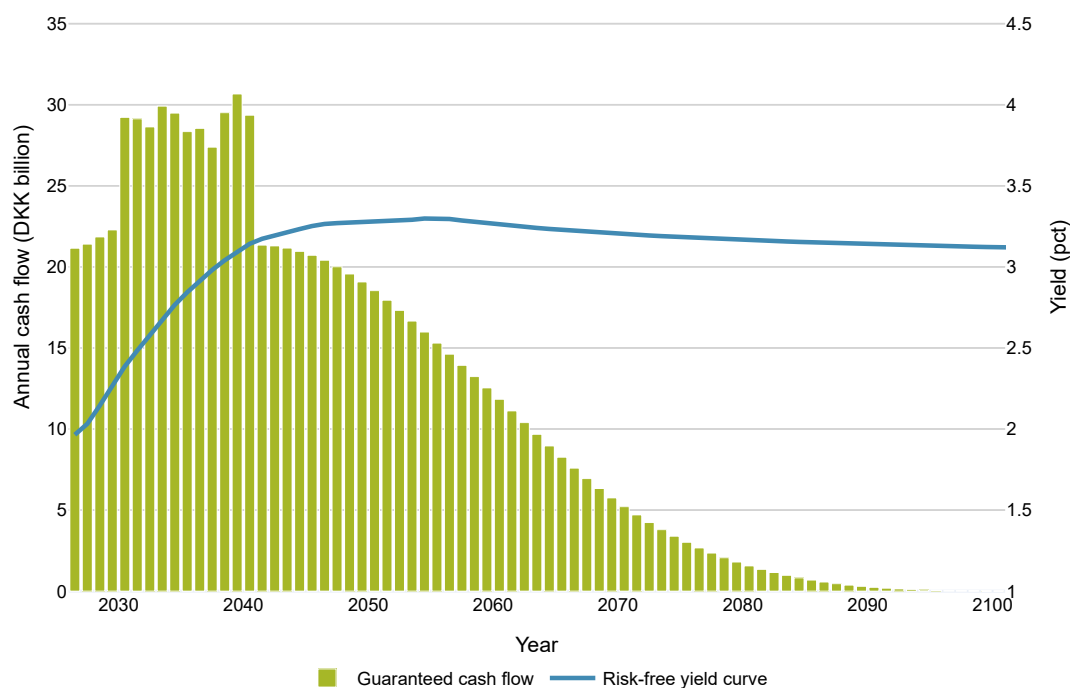


Exhibit 5.15: Guaranteed cash flows and discount curves. The figure illustrates ATP's guaranteed cash flows as well as the discounting curve before PAL tax as of December 31, 2025. The irregular cash flows within the first 15 years are related to the rolling annuities.

ATP uses mark-to-market, computed in a manner where assets and liabilities trade in a well-functioning market. Mark-to-market should be used as much as possible in the Annual Report. Assets and liabilities should be measured at their daily values unless the Danish Financial Supervisory Authority decides otherwise. ATP must use a recognized approach to calculate

daily values for the asset or liability that do not trade in a well-functioning market. The change to use mark-to-market accounting was introduced in 2002.

5.5.3 Illiquidity spreads and the Long-term Supplementary Reserve

Key message

Members in ATP do not have an option to surrender their policies and hence the guaranteed cash flow is highly illiquid. To account for this, an illiquidity spread is added to the discounting curve. The difference between the discounted value of the Guaranteed Benefits with and without the illiquidity spread is called the Long-term Supplementary Reserve (LSH).

The Long-term Supplementary Reserve signifies that the guarantees have some loss-absorbing capacity, but only in the short-term, consistent with the fact that ATP must deliver the obligated cash flows at retirement. The Long-term Supplementary Reserve introduces risk capacity in the Guaranteed Benefits, enabling ATP to take on more investment risk. Hence, there is a dedicated asset portfolio, the Supplementary Hedge Portfolio (SAP), matching the Long-term Supplementary Reserve.

The value of the Long-term Supplementary Reserve changes on a daily basis due to:

- Changes in the discount rate.
- Profit and loss from the Supplementary Hedge Portfolio.

The profit and loss accumulates a surplus (or deficit over time). If the accumulated surplus exceeds an upper threshold, funds will be transferred to the Bonus Potential. If an accumulated deficit falls below a lower threshold, funds will be transferred from the Bonus Potential. This makes the Bonus Potential the ultimate risk-absorbing buffer.

The members in ATP do not have an option to surrender their policies and hence the guaranteed cash flow is highly illiquid, and to reflect this, an illiquidity spread is added to the discount curve. This rises linearly from 0 bp at maturity zero to 50 bp at 20 years and remains constant beyond that point, as shown in Exhibit 5.16. The spread matches liquidity characteristics of the pension obligations and aligns with IFRS 17, which requires that the discount rate used for insurance and pension liabilities reflect the liquidity characteristics of the underlying insurance contracts. Since there are no market instruments directly corresponding to ATP's illiquid pension obligations, ATP uses expert judgement utilizing market input and historical data while explicitly documenting the logic behind the adjustment. The spread is generally reviewed annually, although this does not necessarily give rise to changes, since the methodology used

induces stickiness in the applied spread.⁶⁶

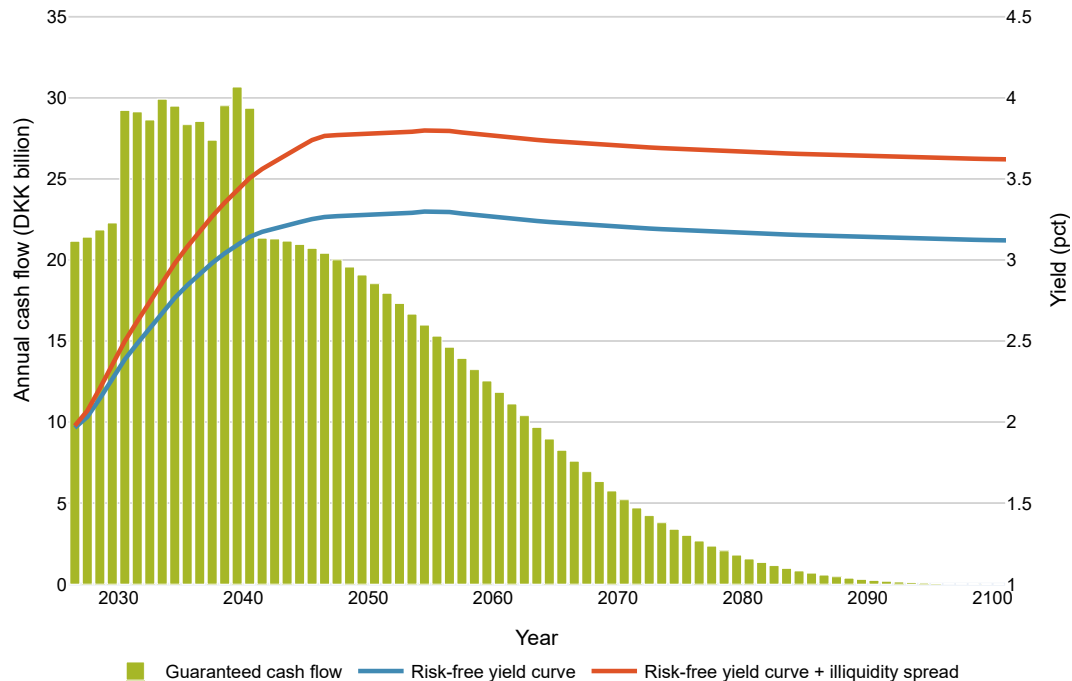


Exhibit 5.16: Guaranteed cash flows and discount curves. The figure illustrates ATP's guaranteed cash flows as well as the discounting curve before PAL tax, with and without illiquidity spread, as of December 31, 2025. The irregular cash flows within the first 15 years are related to the rolling annuities.

The difference between the discounted value of the Guaranteed Benefits with and without the illiquidity spread is called the Long-term Supplementary Reserve (LSH). The Long-term Supplementary Reserve signifies that the guarantees, to some extent, have a capacity to absorb some financial losses on investments, but only in the short-term, consistent with the fact that ATP must deliver the obligated cash flows at retirement. The Guaranteed Benefits calculated without an illiquidity spread still comprise the base at which the bonus is allocated. The value of the Bonus Potential, ATP's ultimate bearer of risk, is unchanged. The bonus ratio thus also remains unaltered by introducing an illiquidity spread.

The Long-term Supplementary Reserve introduces risk capacity in the Guaranteed Benefits enabling ATP to take on more investment risk. There is therefore a dedicated portfolio, the Supplementary Hedge Portfolio (and abbreviated SAP, using the Danish acronym), matching the Long-term Supplementary Reserve. The Long-term Supplementary Reserve is constructed such that its value changes on a daily basis due to:

⁶⁶Solvency II has a volatility adjustment that shares some of the features of the SAP construction. The volatility adjustment was officially justified by a desire to reduce the instability coming from divestments by pension funds. However, it also had an element of forbearance.

1. Changes in the discount rate.
2. Profit and loss from the Supplementary Hedge Portfolio.

Point 1 stems from the fact that the present value of the illiquidity spread is a function of the level of the term structure of interest rates. Point 2 reflects that as the Supplementary Hedge Portfolio invests in risky assets, it accumulates a profit and loss over time. This profit and loss is matched directly with the Long-term Supplementary Reserve and hence the accumulated profit and loss changes the value of the Long-term Supplementary Reserve. The Long-term Supplementary Reserve has a risk capacity equivalent to the present value of the illiquidity spread on the guaranteed cash flows. Accordingly, if the Supplementary Hedge Portfolio accumulates a loss so large that the accumulated profit and loss corresponds to the negative of the value of the illiquidity spread, the risk capacity is fully depleted, and funds from the Bonus Potential will need to be transferred to the Long-term Supplementary Reserve. Conversely, if accumulated returns are so large that they exceed a defined threshold, the value of the Long-term Supplementary Reserve exceeds the risk capacity defined by the illiquidity spread by a material margin. In such a case, there is a transfer from the Long-term Supplementary Reserve to the Bonus Potential. The Long-term Supplementary Reserve can absorb losses in the short and medium term, but its capacity is bounded by the present value of the illiquidity spread on the guaranteed cash flows; if losses persistently hit investments over the long run, this capacity is eventually depleted, and the Bonus Potential is the ultimate risk carrier in the long run.

5.5.4 From liabilities to asset portfolios

Key message

There are five major liability items on ATP's balance sheet, the sum of whose market values are equal to the assets under management (AuM):

1. Bonus Potential (BP)—the ultimate risk-absorbing collective buffer.
2. Guaranteed Benefits (spread-adjusted).
3. The reserve for the Life Annuity with Market Exposure (H_m).
4. Long-term Supplementary Reserve (LSH)—the loss-absorbing part of the guarantees.
5. Risk adjustment—provision for uncertainty regarding non-financial risk.

The first four liabilities have a “risk covering” asset portfolio where the profit and loss fluctuations of the liability item are matched by the change in value of the asset portfolio,

Key message (continued)

either perfectly or imperfectly. There are four main asset portfolios:

1. Investment Portfolio (INV).
2. Market Return Portfolio (M).
3. Supplementary Hedge Portfolio (SAP).
4. Interest Rate Hedge Portfolio (AFD).

The market values of the four asset portfolios do not exactly equal the market value of their corresponding liability item. The first three portfolios are the “Risk-seeking Portfolios” that serve the purpose of growing pensions more than what is promised in the pension rights.

Any profit and loss mismatch between a covering portfolio and its liability item, whether stemming from market, insurance, or operational risk, ultimately lands in the Bonus Potential. Hence, the Investment Portfolio is the ultimate residual portfolio on the asset side.

There is a fifth portfolio, the Treasury Portfolio, whose purpose is not to cover market risk of a liability item, but rather to utilize excess liquidity in ATP's balance sheet to fund leveraged positions in the four covering portfolios and manage liquidity risk in these. The Treasury Portfolio enables the use of leverage in the Risk-seeking Portfolios.

There is also a tax asset on the balance sheet. The tax asset arises from losses in investment returns, primarily in 2022. This government receivable yields zero interest and causes a running funding cost on ATP's investments

Each major liability component has a corresponding covering portfolio.

The Interest Rate Hedge Portfolio, AFD, supports the guaranteed nominal obligations. Its objective is to match interest rate exposure excluding illiquidity discount and ensure the nominal guarantee can be honored. There will be a residual profit and loss, because the Guaranteed Benefits are hard to match perfectly. The residual profit and loss is transferred to the Bonus Potential. The Interest Rate Hedge Portfolio will be explored further in Section 6.2.

The Supplementary Hedge Portfolio, SAP, as discussed in Section 5.5.3, covers the Long-term Supplementary Reserve. It contributes to ATP's ability to generate a surplus on top of the tariffs, by utilizing the loss-absorbing capacity available due to illiquidity in the guarantees.

The Supplementary Hedge Portfolio is an overlay portfolio, as it does not have its own funding base, apart from the accumulated undistributed surplus. When the surplus is sufficiently large, an allocation to the Bonus Potential is made, effectively increasing the funds available for bonus to members.

The Market Return Portfolio, M, which is invested in risky assets, supports the annuity with market exposure. By construction, the Market Return Portfolio is the perfect hedge of the reserve related to the annuity with market exposure as profit and loss is transferred one-to-one.

The Investment Portfolio, INV, invests on behalf of the Bonus Potential and returns on the Investment Portfolio provide the capacity to allocate bonus to members. All profit and loss from the Investment Portfolio enters the Bonus Potential, which is the ultimate risk-absorbing liability item. Thus, the Bonus Potential carries profit and loss from changes in life expectancy, mismatch profit and loss from the Interest Rate Hedge Portfolio, excessive accumulated profit and loss from the Supplementary Hedge Portfolio, and returns from the Investment Portfolio.

To support liquidity needs, leverage and risk-taking, ATP runs a Treasury Portfolio. The Treasury Portfolio obtains funding from the cash release arising from using interest rate swaps instead of bonds for roughly 50 pct of the Interest Rate Hedge Portfolio. The Treasury Portfolio provides internal loans to the other portfolios, invests in short-term bonds and cash deposits, as well as FX forwards for currency hedging and handles liquidity and collateral management. More details on the Treasury Portfolio are provided in Section 6.2.

Formally speaking, the Bonus Potential serves many of the functions of equity. However, the 20 pct is not formally equity as it is the beneficiaries' contribution, not a sponsor's contribution. ATP refers to a bonus ratio as the funding ratio minus one (Section 4.1.1).

Thus, the components of the asset and liability sides are interconnected, as shown in Exhibit 5.17. The liability side is illustrated with and without illiquidity spread while the asset side is illustrated in net market value and gross market value terms. The exhibit also provides definitions of terms used in the report: The "collective buffer," the "value of the pension rights," the "pension liabilities" the "loss absorbing capacity," the "hedging business area", the "investment business area" and the "Risk-seeking Portfolios' own funding."

Review of ATP's Investment Strategy

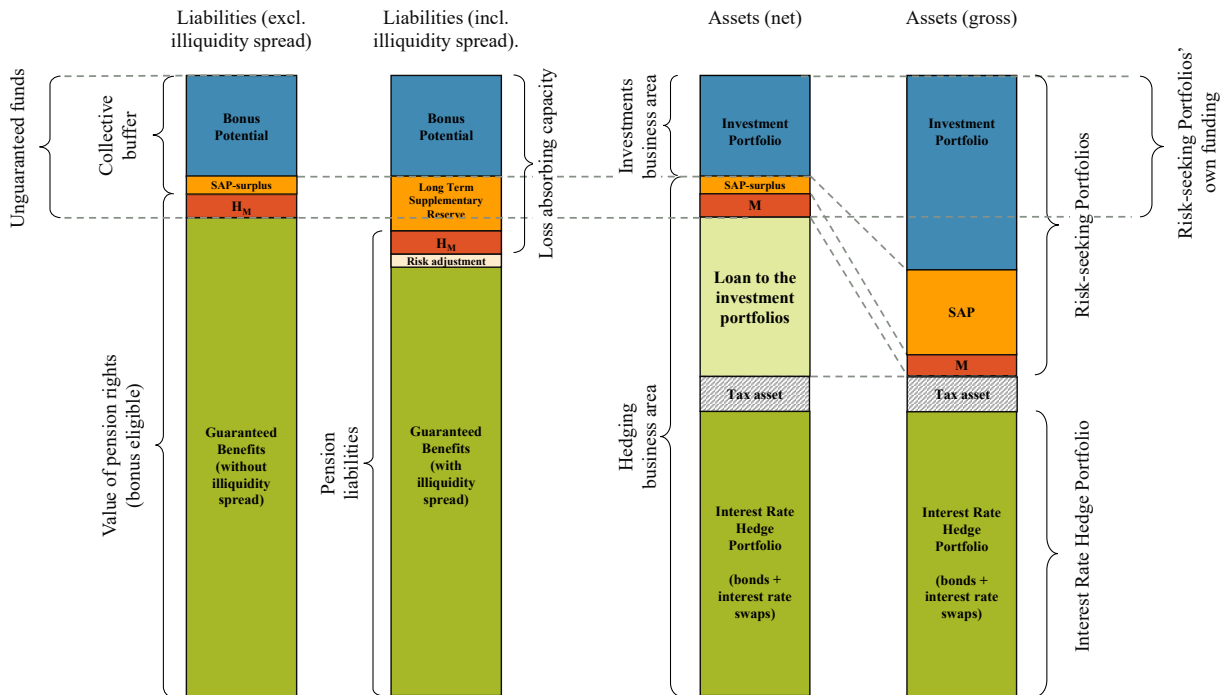


Exhibit 5.17: ATP's liabilities and assets. The first column to the left shows the liability side without illiquidity spread, hence there is no LSH. However, the surplus from SAP does exist (it is around DKK 7 billion as of December 31, 2025). In the second column from the left, the illiquidity spread is included in the liability side. The difference between SAP surplus and LSH equals the effect from the illiquidity spread. The third column from the left shows the asset side expressed in net market values, that is, gross market value minus the loan received from the Treasury Portfolio. The net market value of the SAP equals the SAP surplus, since the rest is fully funded by a loan from the Treasury Portfolio. SAP does not have its own funding base. The net market value of the Interest Rate Hedge Portfolio is much less than the Guaranteed Benefits, due to interest rate risk being partly taken via interest rate swaps. The final column shows the gross value of the asset side, that is, the market value of the assets owned and the market value, not notional exposure, of the derivatives positions. This illustrates only part of the leverage present in the portfolios as the leverage taken via derivatives is not visible (a more detailed discussion of leverage is in Section 6.6.3).

Since the tax asset needs to be funded by ATP, this appears directly on the balance sheet. Definitions of terms used in different places in the report are provided: "Collective buffer," "value of the pension rights," "pension liabilities," "loss absorbing capacity," the "hedging business area", the "investment business area" and the "Risk-seeking Portfolios' own funding."

The contribution flows into annuities can be extended to the various liability items. Exhibit 5.18 below serves as an extension of Exhibit 5.14. The internal flows are highlighted, including the transfers between the Long-term Supplementary Reserve and the Bonus Potential, and the connection to the asset portfolios.

Review of ATP's Investment Strategy

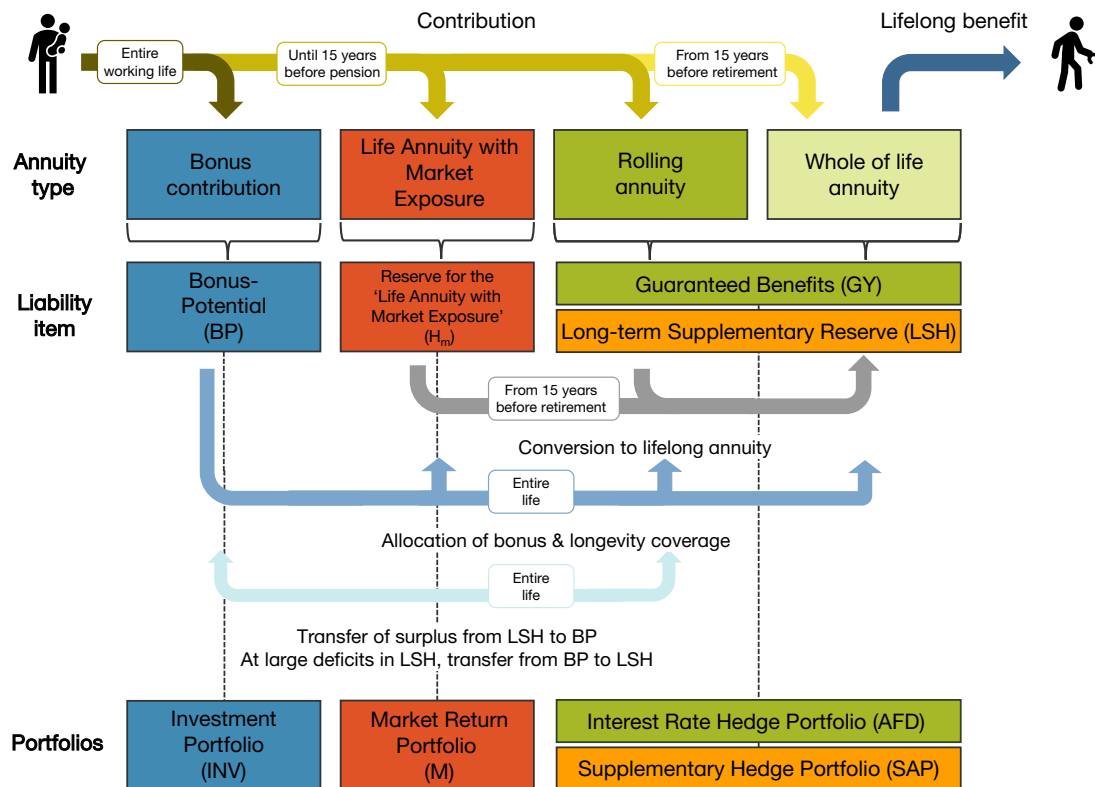


Exhibit 5.18: Link between liabilities and portfolios.

5.5.5 Evolution of ATP's balance sheet and architecture

Key message

The ATP product has changed over time, and each change has brought about an increase in complexity of how the investments are managed. The most recent changes are the introduction of the Supplementary Hedge Portfolio in 2023, the introduction of the Market Return Portfolio in 2022, and the change to 15-year interest rate hedging in 2015.

The timing in implementing the change has sometimes, in retrospect, been poor, as it has resulted in losses.

As a result of the changes, the ATP pension has become more similar to defined contribution products on the asset side, while maintaining the ultimate obligations.

Evolution in the ATP product

ATP has been in place for more than six decades, but existing commitments have been honored when new products were introduced. However, existing commitments were never converted when the product was updated. This means that a large portion of today's liabilities were written under older product designs. Exhibit 5.19 shows a timeline of the evolution of the pension product. When ATP was founded, it was quite generous to the elderly generation, and

it was underfunded in the early years. ATP has since reached full maturity.

More modern actuarial pricing of pension rights happened gradually and was certainly in place with the introduction of "Scheme 2" in 2002, where a flat tariff of 2 pct was adopted. The flat tariff scheme had the disadvantage that the implicit relative contribution to the Bonus Potential varied over time with fluctuations in interest rates. With high interest rates, the value of the guarantee on the back of the specific contribution is low, and vice versa. As a result, members' relative contribution to the Collective Buffer was volatile and depended on the prevailing market interest rate. This reduced transparency and raised concerns about fairness, as the timing of the contribution affected relative contributions to the collective.⁶⁷ To address this, a new scheme for tariffs was introduced in 2008, where the tariff is now equal to the prevailing risk-free market interest rate. When the contribution is made, it is clear what is paid into the guarantee (80 pct) and what is paid into the Collective Buffer (20 pct).

The changes to the business model in 2015 and in 2022–2023 were introduced to increase returns. The rolling annuity, as described in Section 5.3.2, was introduced in 2015. The new business model with the Long-term Supplementary Reserve and Life Annuity with Market Exposure was introduced in 2022. Equity risk and other forms of non-interest rate risk have increased, and interest rate risk has been reduced. The two most recent changes, the introduction of the Long-term Supplementary Reserve and Life Annuity with Market Exposure, have been made with the aim of making it easier to achieve the twin objectives of a nominal guarantee and indexation increases.

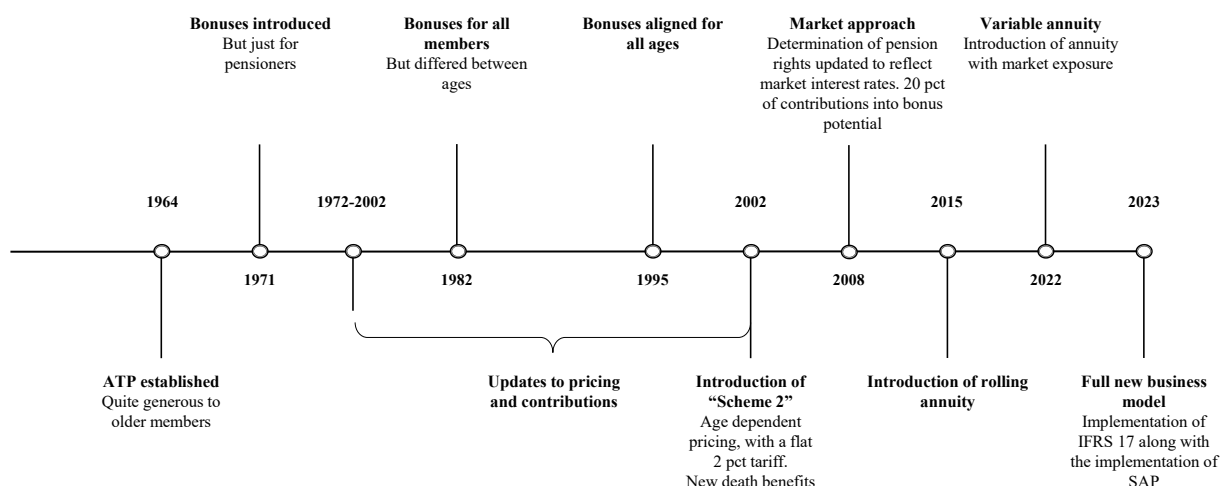


Exhibit 5.19: Development in ATP's pension product.

⁶⁷Flat tariffs in guaranteed products are still the norm in the Danish pension sector; the size of the so-called "individual bonus potential" therefore fluctuates with market rates. It represents how much loss-absorbing buffer the individual provides to the collective due to the fact that market rates are higher than the flat rate the individual accrues in the guarantee at the time of the premium payment.

ATP's liabilities generally increased until 2020 but fell significantly in 2022. Exhibit 5.20 illustrates the evolution of the liability side of the balance sheet since ATP started using market-based valuation of all balance sheet items. The major drop in AuM during 2022 stems from both losses in the Investment Portfolio and the Interest Rate Hedge Portfolio; the latter also reflected reductions in the Guaranteed Benefits. (We investigate these changes further in Chapter 7.) The losses generated a material negative total return on AuM that year, which in turn gave rise to the large tax asset depicted in Exhibit 5.20.

Before 2022, there were fewer items on the liability side. The new items appearing from year 2022 and onwards originate from the introduction of “the new business model,” which introduced Life Annuity with Market Exposure, the illiquidity spread in the discount curve, leading to the Long-term Supplementary Reserve and the Supplementary Hedge Portfolio. The upshot of those changes was an increase in ATP's loss absorbing capacity and an ability to assume more investment risk on the balance sheet. This should ultimately increase the ability to deliver higher bonuses and to increase the ability to write-up pensions with realized inflation. On the other hand, the new business model brings more complexity. (We evaluate the new business model in Chapter 7.)

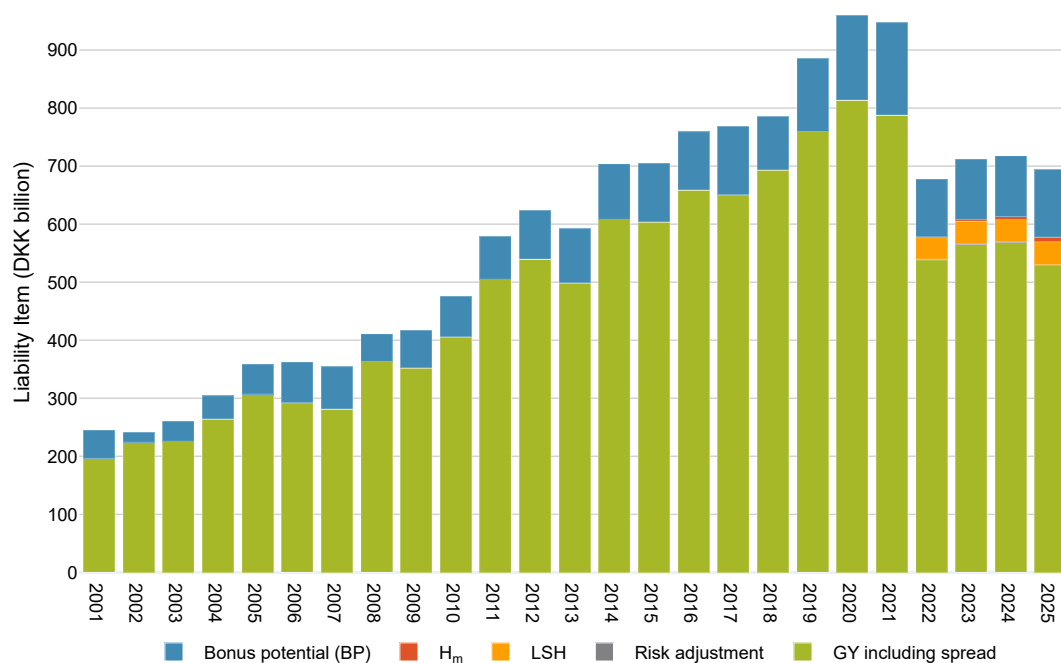


Exhibit 5.20: ATP balance sheet items. The figure depicts the development in ATP's total wealth (assets under management) starting on January 1, 2002 and ending December 31, 2024. The financial year, 2002, is the first year, where all items in the balance sheet were evaluated according to market value principles and the PAL taxation was harmonized across all asset categories. The graph decomposes the major liability components of ATP. LSH appears already in the year 2022. This is due to reconciliation in accounting statements.

Evolution in ATP's discount curve

The discount curve has seen multiple iterations throughout ATP's modern history. The iterations reflect market conditions and the ability to hedge the liabilities. Exhibit 5.21 shows a timeline of the evolution of the discount curve. The first notion of market-based discounting of the cash flows was introduced in the fiscal year 2002, with the adoption of market value-based pricing of all assets and liabilities. In particular, the value of the Guaranteed Benefits was calculated via a discount curve consisting of DKK swap rates. At the end of 2011, ATP changed its discount curve from solely using Danish swap rates to using interest rates from Danish and German government bonds and Danish kroner and euro interest rate swap rates. This change reflected market liquidity and impacted how ATP hedged its liabilities.

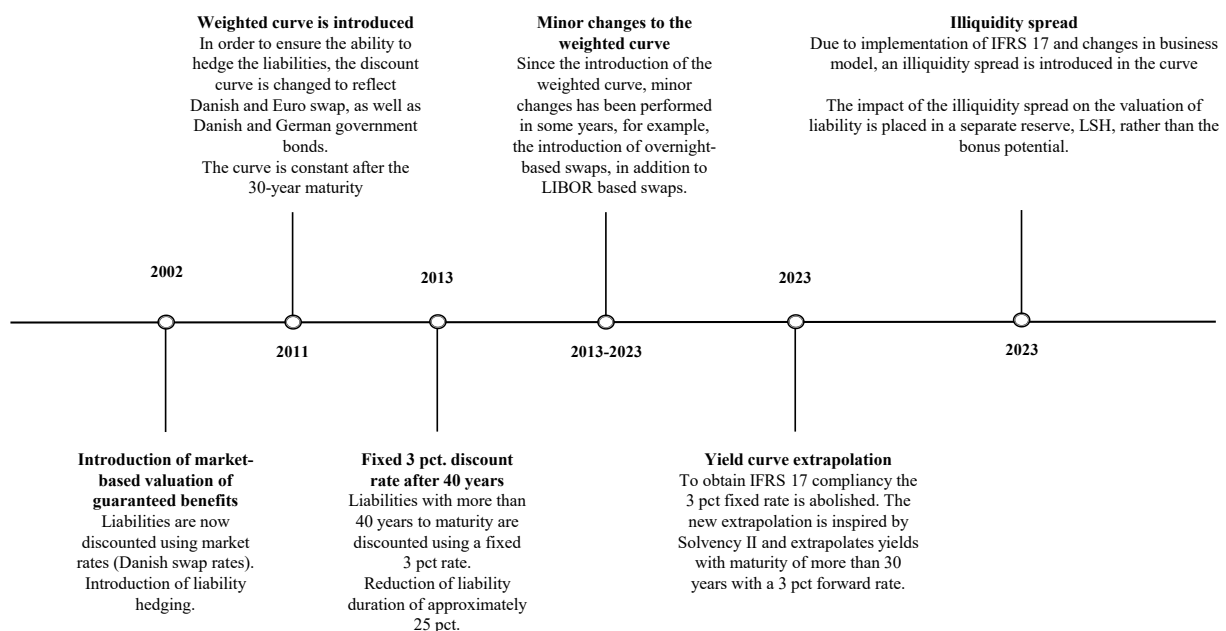


Exhibit 5.21: Developments in ATP's discounting curve.

From mid-2012, the Danish pension sector (excluding ATP) was allowed to pre-implement the Solvency II discount curve (the so-called Smith-Wilson discount curve), which extrapolated discount rates greater than 20 years towards a so-called Ultimate Forward Rate of 4.2 pct. This change reduced the duration required to hedge the liabilities, while also inducing an additional return requirement to make up for the difference between the extrapolated rates in the discount curve and the prevailing market rates—this is essentially equivalent to not fully hedging the economic value of the liabilities.

By the end of 2013, and in line with the above reasoning, ATP switched to a discounting curve that significantly reduced sensitivity to changes in long-term interest rates. The new curve used market rates up to maturities of 30 years, but from 30 years to 40 years it applied the 30-

year interest rate and from 40 years and onwards applied a fixed 3 pct interest rate. As in the case of the Solvency II curve, the change significantly reduced the duration required to hedge the liabilities, as it effectively left liabilities with maturities over 40 years insensitive to changes in interest rates. From a timing perspective, this turned out to be costly, since the amount of duration in the Interest Rate Hedge Portfolio was equivalently reduced hence missing out on substantial returns in the subsequent years as interest rates fell from 3 pct to zero. (Market dynamics of this period are discussed further in Section 7.2.)

Fixing the long-term discount rate to 3 pct incurred a running cost (or surplus) depending on whether the true long-term market interest rate was lower (or higher) than 3 pct. Concretely, if the 30-year interest rate, which was used to discount cash-flows at maturities below 40 years, was below 3 pct a cost would occur: Every month a cash flow bucket switched from being 40 years to less than 40 years, a discrete downward jump in the discount rate happened. This gave rise to a positive change in the present value of the cash flow, which would not be matched by the Interest Rate Hedge Portfolio. When the switch in discounting curve was made, ATP “tagged” selected assets, mainly real estate and infrastructure, which could earn 3 pct in the long run. Initially it would seem that the increased return requirement would be addressed by the “tagged” assets but the above-mentioned mark-to-market impact of crossing the 40-year maturity point was not covered.

The differences between market rates and the assumed long-term rate have had high costs. Exhibit 5.22 shows the monthly cost hitting the Bonus Potential arising from the above-mentioned issue. When the discounting curve was introduced, with long-term rates close to 3 pct, the impact was negligible. However, when interest rates decreased, the running losses needed to be covered by the Bonus Potential, essentially acting as a headwind for the Investment Portfolio. The monthly costs were highest, around DKK 500–600 million, in the period around 2020 when interest rates were hovering around 0 pct. This meant that in annual terms, a multi-billion amount, around 5 pct of the Bonus Potential was lost due to the artificial discount curve construction. At present, when interest rates are around the level of the assumed long-term rate, the cost is much closer to zero.

In 2023, the discounting curve was changed to the set-up known today (see Section 5.5.3). Since the current discount curve still uses a non-market-based long-term rate, albeit with another extrapolation method, the inherent problem of facing a headwind, when market rates are low, and a tailwind, when market rates are high, is still present. Currently, market rates are close to the assumed long-term rate and the running cost is low.

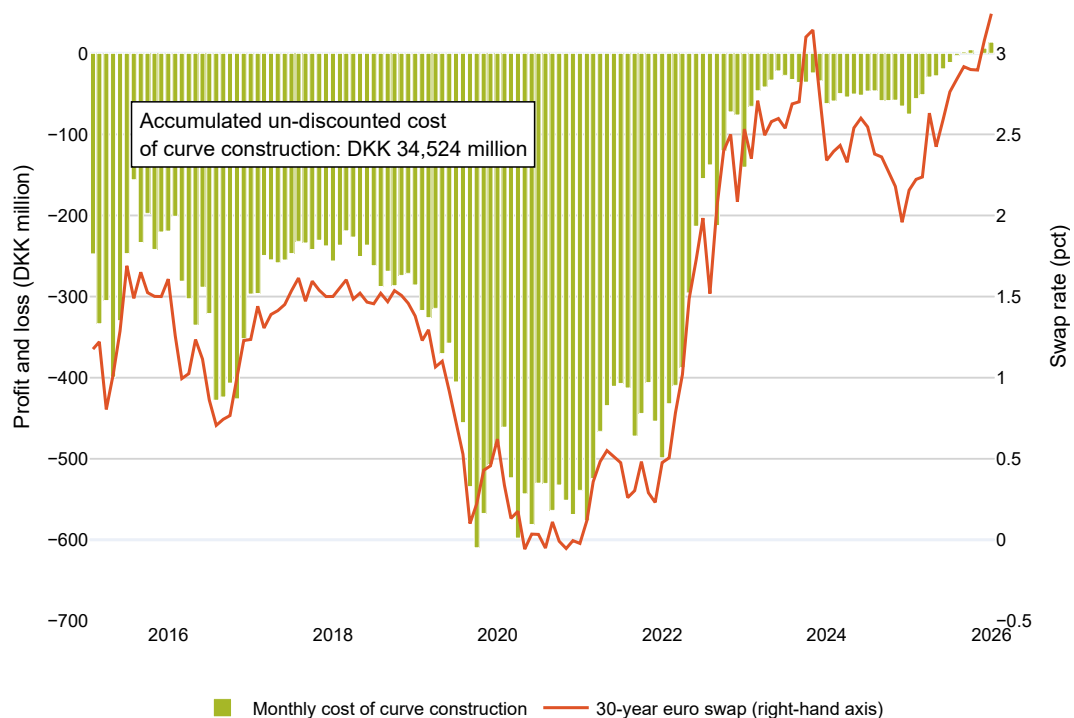


Exhibit 5.22: Cost from the discounting assumptions. On the left-hand side, the monthly cost (reported as negative “carry”) arising from the curve construction is depicted. Until January 2023, it arises from the fact that discounting rates from the 40-year point and outwards were fixed at 3 pct while maturities just under 40 years to 30 years were discounted at the prevailing 30-year zero coupon interest rate. Every month a cash flow bucket switches from being 40 years to less than 40 years, a discrete jump in the discount rate happens, giving rise to a change in present value of the cash flow. A 30-year interest rate which were greater than 3 pct gave risk to a loss, where an interest higher than 3 pct gave to a profit. The change in curve construction in January 2023 to a smoothed curve via extrapolation does not remove the cost, although it will be less directly linked to the 30-year interest rate. The right-hand side depicts the 30-year euro interest rate swap rate. Although the actual discount rate differs, the relationship between the costs from the discounting assumptions and the prevailing market interest rate is evident.

5.5.6 New business model

In 2021 substantial changes to the ATP Act were proposed to the Danish Parliament, introducing a “new business model” for ATP. The over-arching objective of the proposal was to strengthen ATP’s ability to deliver the best possible pensions to its members, while duly safeguarding ATP’s core mandate of providing a basic level of financial security through guaranteed, lifelong pension benefits, supplementary to the state pension. The proposal was also intended to expand ATP’s investment flexibility and enable a higher overall ATP Lifelong Pension, while maintaining its ability to provide financial security for its members. The increased investment flexibility would be deployed towards assets with higher risk with the aim of increasing pensions.

The major changes introduced in the new business model were:

Introduction of the Variable Annuity

For 20 pct of the contributions for members with more than 15 years to retirement (see Section 5.3), contributions are paid into a pension right, where the returns generated on a diversified portfolio determine the value of the accrued pension rights. The Supervisory Board of ATP determines the risk level and composition of the associated diversified portfolio (the Market Return Portfolio (M)), see Section 5.5.4. Thus, the contributions do not have a guaranteed return, but the contribution still has a longevity guarantee. This part of the contribution is called the *Market contribution*. From fifteen years to retirement onwards these annuities are gradually converted into whole-of-life annuities. At retirement, a member who has saved in the variable annuity has no direct market exposure on their benefits (but there is indirect market risk through the Bonus Potential and bonus allocations). For members who paid into the Variable Annuity, the portion of their pension attributable to those contributions will vary with the investment returns of the Market Return Portfolio rather than being fixed in advance. ATP reports the evolution of these pension outcomes through its standard member disclosures, consistent with current practice.

*The maximum Market Contribution is 25 pct of the Guarantee contribution—currently corresponding to 20 pct of the total contribution.*⁶⁸ The current level of the Market Contribution is at its maximum. The Market contribution was introduced from 2022 and onward, and thus the size of the reserve related to the Variable Annuity is still limited, as the contributions are small compared to the stock of pension rights. As of end of 2025 the reserve related to the Variable Annuity is DKK 8 billion, compared to a total balance sheet of DKK 694 billion.

Amended hedging strategy

Whereas the variable annuity mainly gives rise to higher pensions for younger members, an amended hedging strategy aimed to increase pensions for all members was introduced in 2023. The adjustment to ATP's hedging strategy preserves the guarantees and lifelong payouts in their current form, while introducing a portfolio of higher-risk assets with expected higher returns alongside the Interest Rate Hedge Portfolio.

The addition of the higher risk assets requires utilizing the risk capacity arising from the long-term illiquid nature of ATP's liabilities, as discussed in Section 5.5.3. From a practical perspective, this involves applying an illiquidity spread and adding the Long-term Supplementary Reserve as a liability item—introduced through the application of IFRS 17 as the accounting standard for ATP. The corresponding item on the asset side is the Supplementary Hedge Portfolio (SAP). (See Section 5.5.4 for the link between liability items and the corresponding portfolio).

⁶⁸The remaining 75 pct of the Guarantee contribution is allocated to the Guaranteed Benefits, which are guaranteed and lifelong, and is called the Interest rate contribution.

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The addition of the higher-risk, higher-return assets implied an acceptance of fluctuations in the overall hedge and an increased risk of insufficient funding to meet guaranteed obligations. This was undertaken with the objective of enhancing returns and, in turn, strengthening the capacity to increase the real value of pensions. This risk was stated in the material set forth to the Danish Parliament in 2021. ATP is required to assess this risk in a model with a long-term perspective, rather than the regular short-term risk measure. We comment on this higher risk level in Sections 6.9 and 7.7.6.

The risk in the Supplementary Hedge Portfolio was gradually implemented between 2023 and 2025, such that the portfolio targets were reached by late 2025. Thus, there is not a long history of returns for the Supplementary Hedge Portfolio, which can be used for evaluating the impact of the change. As of end of 2025, the Long-term Supplementary Reserve (LSH) is DKK 39 billion, where approximately DKK 34 billion is the estimate of illiquidity in the Guaranteed Benefits, and approximately DKK 6 billion are from returns on the Supplementary Hedge Portfolio.

5.6 ATP governance of investments

Key message

The overall characteristics of the ATP product are defined by the ATP Act, while some of the key features of the ATP product, and the investment strategy are set by ATP's Board of Representatives or the Supervisory Board.

ATP's daily management is responsible for the more granular strategic choices and the implementation of the investment strategy.

Decisions regarding ATP's pension product, investment strategy, and implementation thereof are either specified by the ATP Act, taken by ATP's Supervisory Board or taken by ATP's daily management. The purpose of this section is to describe the distribution of responsibility in relation to investments. Appendix C elaborates on the legislation governing ATP and governance more generally. Exhibit 5.23 illustrates the various decisions made with the ATP Act, by the ATP Supervisory Board and by the daily management of ATP.

Review of ATP's Investment Strategy

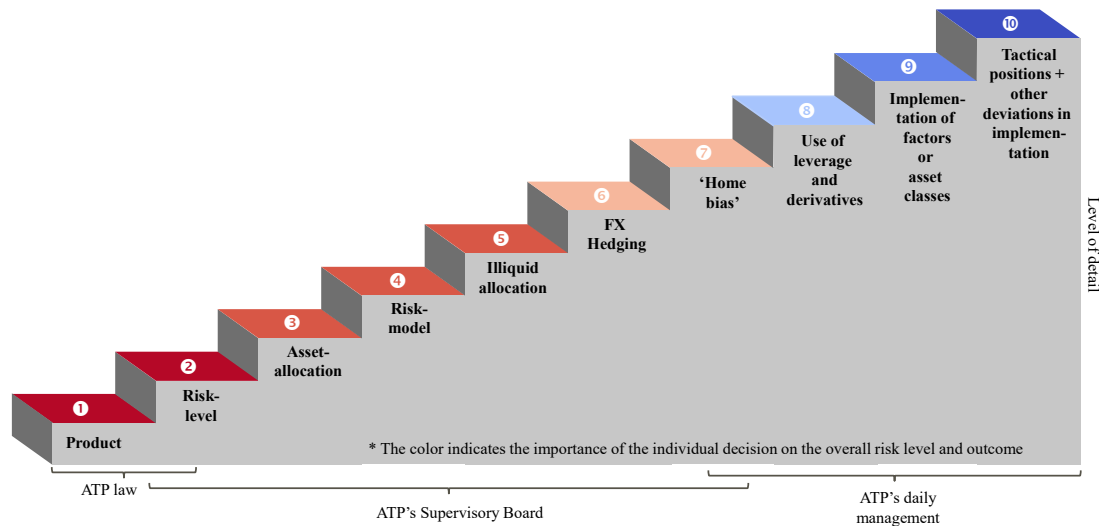


Exhibit 5.23: Overview of governance at ATP. The steps describe the order of the decisions made in order to implement the ATP pension product and investment strategy. The color describes the importance of the particular decision (red being more important than blue).

The overall characteristics of the ATP product are defined by the ATP Act. The act defines the objective of ATP as well as the design and structure of the ATP product, the guarantee and striving to ensure the real value of pensions. Many of the considerations in the ATP Act are further expounded in a series of executive orders. For example, the tariff is updated each year through the “tariff executive order,” and ATP’s approach to publishing accounts is specified in the “executive order on accounting.”

Some of the key features of the ATP product, such as the size of the annual contribution to ATP and the tariffs, are set by ATP’s Board of Representatives or the Supervisory Board. The annual contribution is the contribution paid by a member employed full time by the same employer. Any change to the annual contribution is approved by a simple majority of votes of the Board of Representatives, subject to the proviso that a majority of employers as well as employee representatives shall vote in favor of the decision. With respect to the tariffs, these are updated each year depending on market circumstances, like the level of market interest rates. The Ministry of Employment sets the tariffs on the recommendation of ATP’s Supervisory Board.

Decisions on the key features of ATP’s investment strategy reside at ATP’s Supervisory Board. Designing and implementing the investment strategy involves a variety of choices. Some choices are driven by product and purpose, others by investment philosophy, and others more implicitly through implementation. (We discuss ATP’s portfolio construction in Chapter 6.) ATP’s investment strategy is presented to the Supervisory Board on an annual basis. Some of the most high-level strategic decisions are the hedging of the liabilities and the size of the risk levels in the Risk-seeking Portfolios—that is, the risk level in the Investment Portfolio, the Market Return Portfolio, and the Supplementary Hedge Portfolio.

While the high-level strategic investment decisions formally lie with the Supervisory Board, the actual decisions are partly constrained due to formulations in the ATP Act. Specifically, to ensure the guaranteed pensions of the members, liability hedging is needed to some extent, and in the pursuit of ensuring the real value of pensions, a high risk level in the Investment Portfolio is required. (We further discuss these investment implications in Section [6.4](#).)

Chapter 6

Construction of the ATP portfolio

Key message

ATP's portfolio construction is organized around the interaction between its guaranteed pension promise and its capacity to bear investment risk: the Guaranteed Benefits are hedged through the Interest Rate Hedge Portfolio and the Treasury Portfolio, return-seeking exposures are defined through a factor framework, and required returns and risk appetite determine how much risk is taken. The Investment Portfolio (INV), Market Return Portfolio (M), and Supplementary Hedge Portfolio (SAP) implement that risk through liquid and illiquid pooled funds, employ leverage, use derivatives, and apply internal funding.

6.1 ATP's investment philosophy

Key message

ATP's investment philosophy rests on explicit beliefs about financial markets, about ATP as a liability-driven investor with a long horizon and a Bonus Potential to protect, and about ATP's role in Danish society. The beliefs together imply that risk is the first-order decision, that diversification is applied at both high and detailed levels, that strategic allocation matters more than tactical, that currency risk is hedged by default, and that ESG is pursued not as an end to itself but as a part of the investment process.

ATP's investment strategy rests on a small number of explicit investment beliefs—stated premises about how markets behave, what the ATP product allows ATP to do, and what role ATP plays in Danish society. As part of its review, we asked ATP to articulate its investment beliefs that guide its investment strategy, and those beliefs are set out in this section. Since these in-

vestment beliefs are directly from ATP, they are presented indented and with a green line in the margin. Making these beliefs explicit is important because they form the link between ATP's abstract objective—delivering a guaranteed lifelong pension with the possibility of additional bonuses—and the concrete portfolio choices that follow: which risks to hedge, which risks to take, which assets to hold, how much leverage to use, and which instruments to use. They also provide a standard against which ATP's Supervisory Board, the members, and the public can evaluate whether the portfolio is being constructed consistently with its stated purpose. We evaluate ATP's investment philosophy in Section [7.3](#)

6.1.1 Beliefs regarding financial markets

ATP's first group of investment beliefs concerns financial markets and are general premises about risk, return, diversification, market efficiency, and the sources of long-term investment performance.

Risk is the primary driver of long-run returns. Empirically, there is a positive relationship between investment risk and returns: investments which are perceived as being riskier would typically carry higher expected returns. Similarly, buying double the amount of a particular stock gives double the amount of absolute return. Thus, over longer periods the overall risk level is likely to be an important driver of absolute returns.

Diversification is valuable. Diversification is central to modern portfolio theory and ATP's investment strategy. For imperfectly correlated assets, diversification can reduce the risk of a portfolio more than it lowers the expected returns as losses in one investment can be offset by gains in another. When diversification is combined with a target level of total risk, leverage may be needed to scale the diversified portfolio to the desired risk level.

Compensated risk comes from a limited number of factors. Risk and expected returns can typically be explained by exposure to a limited number of underlying factors. The factors can be macroeconomic factors (such as growth), style or security-specific factors (such as earnings growth or company size), or directly investable portfolios designed to harvest specific risks, like interest rate risks. Managing exposures at the level of factor risks is important to ensure diversification and achieve high and durable long-term returns.

Strategic asset allocation matters more than tactical market timing. Choosing a good strategic asset allocation has a larger impact on the long-term returns of a fund than tactical asset allocation. Strategic asset allocation should set the basic principles regarding risk and allocations; however tactical allocations may have a role in capturing temporary dislocations or by providing some protection for the portfolios against drawdowns. When choosing

the strategic asset allocation, it is important to acknowledge that the inputs for the decisions are typically imprecisely estimated and robustness must be evaluated.

Financial markets are mostly efficient. Financial markets generally incorporate available information into prices, making it difficult to generate systematic alpha through active trading, as inefficiencies tend to be traded away by the financial markets. Over shorter periods, dislocations can give rise to opportunities, but some of these opportunities may not be investable to larger investors. Overall, ATP subscribes to an “efficiently inefficient” view of markets: where market participants can make a small alpha by doing research, but not on an unlimited scale.

Private market assets make a positive contribution to a portfolio. Private markets can provide access to investment opportunities that are not accessible in public markets. Private assets can potentially offer an illiquidity risk premium, as investors require additional compensation for not being able to rebalance their portfolio or withdraw their capital. In addition, the complexity of private assets is typically higher than the equivalent public assets, thus ATP must evaluate to which extent there is a compensation for complexity. ATP views its private market investments through a ‘Public Market Equivalent’ lens, that is the same risk taken in private markets should be at least as attractive as the equivalent public market asset, with additional compensation for illiquidity and complexity risk.

6.1.2 Beliefs based on the ATP product

ATP's second group of investment beliefs follows from the design of the ATP pension product and the structure of its balance sheet. This creates comparative advantages and constraints, which are not necessarily present for other investors. ATP is a Liability Driven Investor (LDI)—its investment strategy begins with the guaranteed pension it has promised to its members.

Hedging uncompensated risks. Gains and losses from unhedged liability risks are ultimately borne by ATP's Bonus Potentials, and thus pension beneficiaries. ATP can choose not to fully hedge its liabilities, but the resulting interest rate position leaves the Bonus Potential exposed to these interest rate risks, effectively lowering the capacity to bear risks that could otherwise be employed to harvest return premiums. Hence ATP hedges the interest rate risk of its liabilities, which allows for more flexibility for taking rewarded risk premiums in the Bonus Potential. If it was optimal to not fully hedge the liability, this position would be taken in the Investment Portfolio, not the Interest Rate Hedge Portfolio.

Balance long investment horizon with short-term protection of the Bonus Potentials. ATP

has a very long investment horizon, as ATP's liabilities span many decades into the future. This allows ATP to be a long-term investor. At the same time, ATP's Bonus Potentials must be protected, as a high bonus ratio (or funding ratio) is necessary to allocate bonuses to ATP's members and cover potential longevity risks. ATP's investment strategy must therefore balance buy-and-hold (or constant risk) elements, with elements which dynamically adjust the risks level to protect the Bonus Potential (that is, considerations regarding constant risk versus a Constant Proportion Portfolio Insurance (CPPI) strategy).

ATP's liabilities and long horizon give it a distinctive investment opportunity set. By hedging its liabilities partly using interest rate swaps, ATP has surplus funding which otherwise would be used to buy bonds in the Interest Rate Hedge Portfolio. This surplus can be used as a stable internal funding source for other investment activities, even if the Bonus Potentials are volatile. This allows ATP to obtain diversification and employ leverage at lower cost than other investors who must rely on external funding to do so. In practice, this allows ATP's Risk-seeking Portfolios to be more diversified than typical investors. Hedging the liabilities has also built broad and deep competences in managing derivative risk; these competences can also be used in managing ATP's Risk-seeking Portfolios.

6.1.3 Beliefs based on ATP's role in Danish society

ATP's third group of investment beliefs is based on its role as a Danish pension institution and from the fact that the vast majority of Danes are ATP members.

ATP has a comparative advantage when investing in Denmark. ATP has a deep understanding of the Danish market, including macroeconomic conditions, political institutions, companies, and sectors. ATP has a long history of a constructive dialogue with Danish listed companies, giving ATP a good understanding of the opportunities and challenges those companies face. As a result, ATP has a higher allocation to Danish equities (public and private) and Danish real estate than other comparable global investors. ATP's size and the role it plays in Danish society domestic role also makes it an attractive partner.

Focus on investment and administration costs. ATP's members are sensitive to costs, as high costs will reduce the pension benefits that the members receive. Given the size of the ATP contribution, it is essential that the administration is efficient and run at a low cost, both for direct costs (such as management fees to investment funds) and indirect costs (such as transaction costs). The fact is that costs are certain, whereas investment returns are not. ATP acknowledges that the implementation of some asset classes and risk premium strategies require special competences and resources and thus have higher implementation costs.

Sustainability is part of the investment process. ATP believes sustainability can help reduce risk and improve long-term returns. Sustainability is therefore part of ATP's investment process, where ESG factors weigh on the investment decisions, and ATP maintains an active dialogue with companies it invests in. Even if sustainability is an integral part of the investment process, it is not a goal in and of itself, and ATP is not willing to give up returns in order to be "greener." ATP's primary objective is to generate the 'best' possible pensions for our members and sustainability is one tool to do so. Stewardship, particularly in Danish equities, is an important part of this approach.

6.1.4 Further implications of investment beliefs

ATP's investment beliefs affect both high-level portfolio construction and implementation. Top-down, they influence the choice of strategic allocation, and at the same time they matter bottom-up in actual implementation.

Peer risk has not been a decisive factor in portfolio construction. Peer risk, that is the risk of being compared to other pension funds or asset managers, has not been a decisive factor when choosing the strategic asset allocation. ATP has placed greater weight on its comparative advantages to deliver higher expected returns for ATP's members. Due to a different risk level than other institutional investors, peer risk would be present even if ATP held the same underlying assets as other institutional investors.

Diversification underpins the asset allocation at both high and detailed levels. ATP applies the principle of diversification not only across the whole portfolio and broad investment factors, but also within sub-factors and individual implementations. This includes geographical diversification, as well as employing a more equal-weighted equity allocation than typical market-cap weighted indices. This can lead to tracking error relative to more traditional indices (including a 60-40 equity-bond portfolio), which can lead to periods of under- or out-performance.

By default, ATP hedges all currency risks. Because of the belief that ATP's should hedge all uncompensated risk and a view that currency risk is, on average, uncompensated risk in the long run, ATP has chosen not to be exposed to currency risk. This is similar to ATP's approach to completely hedge its guaranteed liabilities. Any deviation from the fully hedged currency position is taken where it is expected to most improve the risk-reward position of the portfolio. Thus any deviation from fully hedged is taken deliberately, rather than arising as a residual from managing a currency hedge ratio.

6.1.5 Further details on ATP's ESG approach

ATP integrates ESG considerations into the investment process where they are expected to reduce risk or contribute to long-term value creation. ATP's starting point is to distinguish between financial materiality (how ESG affects portfolio risk and returns) and impact materiality (how portfolio companies affect society and the environment). ATP has developed several ESG principles to guide the work with ESG integration.

Financial materiality. At the portfolio level, ATP asserts that the main protection against sustainability risks is to hold a well-diversified portfolio. At the company level, ATP considers sustainability issues in connection with major unlisted investments, and embeds sustainability considerations in both processes for new investments and ongoing asset management. ATP is generally reluctant to restrict the investment universe too far, since shrinking the investment universe can reduce returns if it precludes ATP from investing in a large part of the available investment universe. Further, ATP is reluctant to exclude entire legal industries or sectors as ATP is the pension company of all Danes. (It is assumed that the Danish Parliament would have sanctioned entire sectors if this was their intention.)

Impact materiality. Stewardship is ATP's preferred tool for addressing negative sustainability impacts; exclusion is reserved for cases when all other alternatives have been exhausted. ATP does not invest in companies that knowingly and repeatedly violate rules set by national authorities in the markets in which the companies operate. ATP's policy also requires that portfolio companies must act in accordance with the standards that follow from the international conventions adopted by Denmark. Companies involved, for example, in the production of sanctioned weapons such as cluster bombs and landmines, are in violation of ATP's sustainability policy. In 2026 we published a new sustainability strategy: ATP strives for all of its portfolio companies to improve on three priority sustainability themes: green transition, working conditions, and governance practices. ATP tracks the development of companies using specific, data-supported sustainability guidelines and reports annually on progress against those guidelines.

6.2 Hedge and treasury portfolios

Key message

ATP's hedge and treasury portfolios are the foundation of its balance-sheet construction: the Interest Rate Hedge Portfolio is designed to meet the guaranteed pension promises by immunizing the interest-rate risk in the Guaranteed Benefits, while the Treasury Portfolio manages the liquidity, collateral, and internal funding that allow the rest of the

Key message (continued)

portfolio to operate.

6.2.1 Hedge asset

The hedge asset is ATP's practical risk-free asset for the guaranteed pension promise. Following the principles in Section 4.1.1, it is the asset portfolio that would allow ATP to meet the guaranteed cash flows if all assets were invested only for that purpose. It is therefore defined by the liability side of the balance sheet rather than by a conventional asset benchmark. Two elements determine the hedge asset: the expected cash flows from Guaranteed Benefits and the discount curve used to value those cash flows.

The hedge asset is designed to hedge all interest rate risk which affects the value of the Guaranteed Benefits but does not take into account longevity risk. ATP's large membership pool diversifies idiosyncratic mortality risk, so realized deaths of individual members do not create material cash-flow uncertainty. But systematic changes in mortality assumptions can change the shape and size of the expected cash flows, which occurred in such as 2018 (see Section 5.3.2). That risk cannot be hedged in financial markets and is ultimately borne by the Bonus Potential. Outside these systematic mortality write-ups, however, idiosyncratic mortality effects are small and so we do take them into account in our analysis below.

The Guaranteed Benefits are valued using the discount curve without adjusting for illiquidity spreads (see also Section 5.5.3). This is important because the hedge asset must be able to support the guaranteed cash flows independently of the size and performance of the Supplementary Hedge Portfolio. The hedge asset is therefore built from DKK- and EUR-denominated government bonds and interest-rate swaps whose interest-rate sensitivities match the Guaranteed Benefits. In practice, the match cannot be perfect, so residual gains and losses flow to the Bonus Potential. We comment on these below in Section 6.2.3.

ATP targets a full hedge of the interest-rate risk in the Guaranteed Benefits. The hedge ratio is defined as the interest-rate duration of the hedge asset relative to the equivalent duration of the Guaranteed Benefits, and ATP's objective is to keep this ratio close to 100 pct.

The hedge asset protects nominal guarantees, not realized purchasing power. ATP uses long-term nominal bonds and interest-rate swaps, whose yields embed expected inflation but do not compensate members if realized inflation is higher than expected. Inflation-linked bonds could provide more direct inflation protection, but the market is narrower, real yields may be low, and such instruments would not by themselves deliver the broader indexation objective in the ATP Act. The separation is therefore deliberate: the hedge asset protects the nominal

pension promise, while the Risk-seeking Portfolios are used to pursue returns that can support future bonus allocations and preserve purchasing power over time.

6.2.2 Interest Rate Hedge Portfolio

Having defined the hedge asset above, ATP constructs an Interest Rate Hedge Portfolio to protect ATP's guaranteed pension promises from changes in interest rates. As discussed in the previous section, the Guaranteed Benefits are long-duration liabilities and their value is highly sensitive to movements in discount rates. ATP therefore constructs a dedicated Interest Rate Hedge Portfolio to offset this sensitivity. Economic theory in Section 4.1 stresses the importance of the separation of the hedging portfolio and the speculative (or risk-taking) portfolio; the objective is not to earn a separate risk premium from interest-rate exposure, but to stabilize the balance sheet so that risk capacity can be used more deliberately in the return-seeking portfolio.

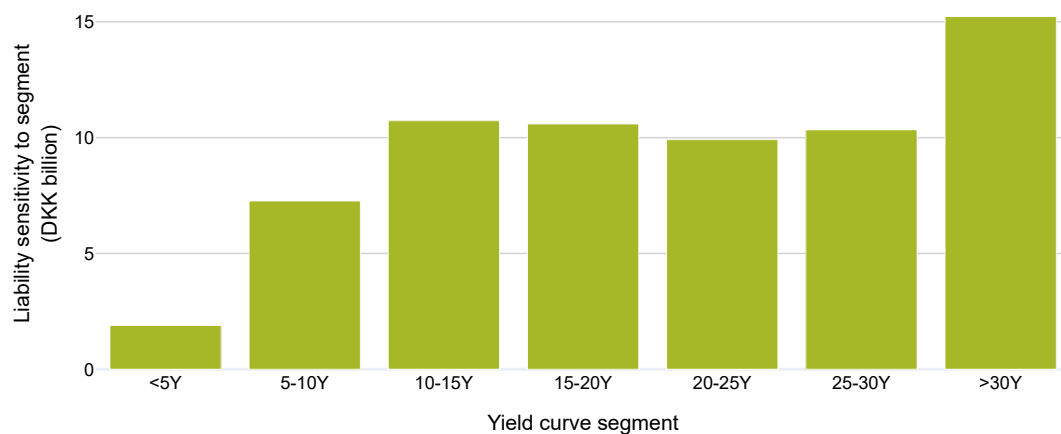


Exhibit 6.1: Key-rate sensitivity of ATP's liability. The figure illustrates the key-rate sensitivities of ATP's liabilities measured in five-year segments.

ATP hedges the interest rate sensitivity of the liability by duration matching. This is consistent with Section 4.1.5. In particular, ATP manages the overall duration (parallel shifts of the yield curve), the sensitivity to various segments of the yield curve (key-rate duration hedges), and exposures to specific yield curves (such as euros versus Danish kroner and bonds versus swaps). Sensitivities are calculated using ATP's discounting curve, which combines multiple input yield curves and extrapolates beyond the yield curve using a long-term forward rate. As an example, Exhibit 6.1 shows the key-rate sensitivities of ATP's liabilities measured in five-year segments.⁶⁹ The hedge is also scaled to take into account tax that is paid on the profits

⁶⁹Key rate duration measures the sensitivity of a portfolio to changes in specific points on the yield curve, rather than to a parallel shift in all interest rates. In ATP's Interest Rate Hedge Portfolio, key rate durations are used to match the interest rate sensitivity of the guaranteed benefits at different maturities, so that the hedge remains effective not only when the whole yield curve moves up or down, but also when the curve steepens, flattens, or changes shape.

from the hedging instruments.

The Supervisory Board sets limits to keep ATP's hedge ratio close to 100 pct. The Supervisory Board also sets limits on key-rate segments and yield curve exposures, but these limits are wider than the limits on the hedge ratio. The wider components allow the implementation of the Interest Rate Hedge Portfolio to take into account market depth and other liquidity considerations.

The liability hedge is implemented with both physical bonds and interest-rate swaps. ATP hedges roughly half of the Guaranteed Benefits with physical bonds and roughly half with swaps. The use of swaps allows ATP to obtain long-duration hedge exposure without tying up the same amount of cash that would be required by a fully physical bond hedge. This structure is central to ATP's balance sheet because it creates a cash surplus of approximately 50 pct of the Guaranteed Benefits that can support liquidity management and internal funding. In addition, for the majority of these interest rate swaps, bonds can be posted as collateral, which adds robustness with respect to liquidity and collateral calls, in case of large changes in interest rates.

Importantly, the hedge asset protects nominal guarantees, not realized inflation, which ATP seeks to provide above the nominal guarantees. The risk-seeking portfolio, which we discuss below, is intended to pursue returns that can support future bonus allocations and preserve purchasing power of the pensions over time.

6.2.3 Treasury Portfolio

The Treasury Portfolio supports the Interest Rate Hedge Portfolio and the rest of ATP's investment structure. Unlike the Interest Rate Hedge Portfolio, the Treasury Portfolio does not correspond to a separate liability item. The Treasury Portfolio is not part of the Interest Rate Hedge Portfolio in the narrow duration-hedging sense: it does not primarily exist to match the key-rate duration of the Guaranteed Benefits. It is, however, part of ATP's broader liability-hedging architecture. The Interest Rate Hedge Portfolio creates the interest-rate hedge through bonds and swaps, while treasury manages the cash, collateral, and liquidity needed to maintain those positions. The role of the Treasury Portfolio is operational: it manages ATP's liquidity, ensures cash is available to pay benefits, posts collateral and margin, manages currency hedging, and provides internal funding to other portfolios.

The cash surplus created by the hedge structure is an important source of internal funding for ATP's Risk-seeking Portfolios. Once ATP has ensured sufficient liquidity and collateral, surplus cash can be held in a bank account or invested in liquid bonds. Surplus cash can also be lent to other portfolios—which allows those portfolios to borrow cheaply. Those portfolios

pay for this funding, so the Interest Rate Hedge Portfolio can meet its own obligations including payments on interest rate swaps. The internal funding mechanism allows ATP's Risk-seeking Portfolios to access cheap and more stable long-term funding.

Overall, the Interest Rate Hedge Portfolio protects ATP's pension promise and the Treasury Portfolio is an important enabler for all of ATP's portfolio construction. The Treasury Portfolio allows the Interest Rate Hedge Portfolio to meet its obligations and, importantly, gives ATP's Risk-seeking Portfolios access to low-cost and long-term funding.

6.3 Factor framework

Key message

ATP's factor framework defines the rewarded returns that the Risk-seeking Portfolios are designed to harvest. Rather than allocating first to asset classes, ATP organizes exposures around four broad factors: Equity, Rates, Inflation, and Other. This structure allows ATP to compare risks across liquid and illiquid assets, combine exposures that have similar economic drivers, and build a more diversified return-seeking portfolio than a conventional equity-bond allocation. The framework is supported by long historical backtests and factor performance across macro regimes. However, the factor portfolios are very different from traditional market-cap-weighted benchmarks and 60-40 equity-bond portfolios.

With the guaranteed liabilities already hedged, ATP organizes its Risk-seeking Portfolios around four investable factors—Equity, Rates, Inflation, and Other—rather than around conventional asset-class labels or the market portfolio. Asset classes still matter for implementation, but they are used to express the broader factor exposures ATP seeks. ATP's efficient portfolio is best viewed as a broadly diversified combination of rewarded exposures across asset classes, geographies, and factor risks, rather than the market portfolio. This section sets out the rationale for factors, defines each factor and its subfactors, summarizes the empirical evidence behind them, and contrasts with market-cap-weighted benchmarks.

6.3.1 Why factors?

ATP organizes its Risk-seeking Portfolios around a small number of investment factors rather than around conventional asset-class labels. This approach is consistent with the empirical asset pricing literature showing there is a parsimonious set of rewarded factor premiums that are reflected across and within asset classes (see Section 4.4.1). Asset classes, especially equities, fixed income, and illiquid assets (see Sections 4.2 and 4.3), remain important for implementa-

tion, but they are not the starting point of the portfolio construction process. Instead, ATP first asks which underlying risks it wants to bear and then selects the instruments and asset classes that provide exposure to those risks.

ATP's factor framework is based on investable factors that create a direct link between the risk being allocated and the instruments that can be held in the portfolio. ATP harvests four factors: Equity, Rates, Inflation, and Other, which are defined in Exhibit 6.2. The factor framework is supported by both theory and practice. The empirical asset pricing literature (Section 4.4.1) shows that a parsimonious set of rewarded factor premiums explains returns both across asset classes (macro factors) and within asset classes (style factors). Constructing portfolios using macro or style factors results in more efficient portfolios with higher Sharpe ratios than market capitalization benchmarks. Other asset managers also adopt factors to build risk parity strategies and several large asset owners construct their total portfolios around macro factors (see Section 4.5.2).

Exhibit 6.2: Overview of ATP's investment factors. The table describes the composition of ATP's investment factors and subfactors. It also shows the typical representation of the given factor.

Factor	Sub-factor	Description	Representation
Equity	Stocks	Risk related to stock price variation	Broad market equity index returns
	Credit spreads	Risk related to credit spread variation	Credit default swap index
Rates	Nominal rates	Risk related to changes in nominal yields	Major nominal government bond returns
Inflation	Input inflation	Risk related to changes in commodity prices	A diversified basket of commodity futures
	Output inflation	Risk related to changes in expected inflation	Inflations swaps
Other	Liquid alternative risk premiums	Risk related to liquid systematic trading strategies	Well-established alternative risk premium (ARP) strategies
	Illiquidity risk	Risk related to the illiquidity of private markets	Case-by-case discretionary modelling

6.3.2 Empirical support

The factors are chosen to make economic sense, but they are also based on statistical evidence. One advantage of using investable risk factors is that there are reasonably reliable data histo-

ries, in excess of 50 years, of the factor premiums. ATP has built a large backtest calculation engine with data going back to 1974 for a global portfolio and back to 1935 for a pure US-based portfolio.⁷⁰ For the data since 1974, Exhibit 6.3 uses a dendrogram analysis that groups assets according to the similarity of their historical returns.⁷¹ In the dendrogram, exposures that join on short branches have historically moved together and are close substitutes from a risk perspective, while exposures that join only through long branches have behaved differently. The dendrogram supports the use of a relatively small number of broad factors rather than a long list of narrowly defined asset classes. Exhibit 6.3 shows that equity and high-yield bonds cluster together, which is consistent with the empirical findings discussed in Section 4.2.2. This motivates the Equity factor, which holds both equities and high-yield bonds. Inflation-related assets of commodities and break-even interest rates (BEI) of nominal rates minus inflation behave differently than equity and fixed income, which motivates treating Inflation as its own factor. Assets exposed to nominal interest rates and alternative risk premiums (ARPs) diversify equity-, credit-, and inflation-related assets, motivating the Other factor.

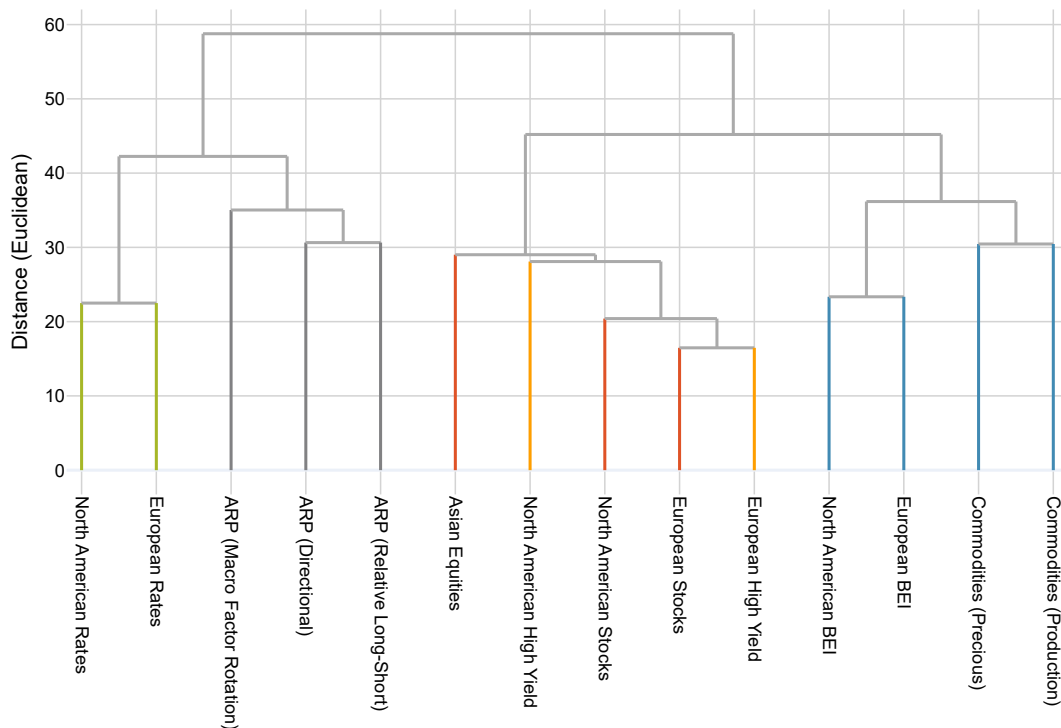


Exhibit 6.3: Dendrogram showing asset clusters. The figure illustrates which assets are clustered together, when performing a cluster analysis on return data since 1974. The lower the distance, the more similar two assets are. Also, assets which meet in the tree (horizontal lines) form a cluster together, where they behave more similarly to each other than other assets (or asset clusters).

⁷⁰Some assets—notably inflation-linked bonds—require backward simulated data.

⁷¹Using a so-called Principal Component Analysis (not reported here) leads to similar factors and dependency as the dendrogram analysis.

The factors in ATP's factor framework have historically earned positive excess returns (positive returns over the riskless rate), but not every exposure is included solely because of its stand-alone Sharpe ratio. Exhibit 6.4 reports the annual return and excess return for the asset classes considered in the cluster analysis. Note that high-yield bonds are included in the Equity factor even though these are bond instruments—this is consistent with the dendrogram analysis above and Section 4.2.2 which discusses that a large component of corporate bond returns is equity beta exposure. All assets entering the factor model have Sharpe ratios between 0.2 and 0.6, except the two break-even inflation strategies. These exposures are included because they diversify the other assets and effectively lower tail risk. Combining individual asset classes into broader factors can improve risk-adjusted returns by diversifying within each factor, giving the overall factor returns with risk-return summary statistics reported in Exhibit 6.5. The two main factors—Equity and Rates—have Sharpe ratios around 0.45 to 0.58, whereas the Inflation factor has a Sharpe ratio of 0.08. The Other factor has a Sharpe ratio of 0.84.

Exhibit 6.4: Returns, excess returns, volatilities, and Sharpe ratios on asset classes in ATP's factors. The table presents annualized returns, excess returns, volatilities, and Sharpe ratios for the asset classes entering into ATP's factors. The asset classes are grouped according to factors and sub-factors. Assets related to credit spreads and break-even inflation are after hedging of nominal interest rate risk, such that the returns proxy a credit default swap or an inflation swaps. Liquid alternative risk premium strategies comprise several strategies described in Sections 5.4.1 and 5.4.3 re-implemented at ATP (see Jensen, Kelly, and Pedersen, 2023 for a description of such a re-implementation).

Sub-factor	Asset class	Return (in pct)	Excess return (in pct)	Volatility (in pct)	Sharpe Ratio
Funding					
Risk-free return	DKK Cash	4.9	-	1.2	-
Equity					
Stocks	North American stocks	12.4	7.4	15.0	0.49
	European stocks	12.7	7.7	14.4	0.54
	Asian stocks	10.6	5.7	17.8	0.32
Credit Spreads	North American high-yield	8.5	3.5	8.1	0.43
	European high-yield	10.0	5.1	11.0	0.44
Rates					
Nominal rates	North American rates	7.1	2.2	7.4	0.30
	European rates	8.1	3.2	6.1	0.52

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Exhibit 6.4 (continued)

Sub-factor	Asset class	Return (in pct)	Excess return (in pct)	Volatility (in pct)	Sharpe Ratio
Inflation					
Input inflation	Commodities (pre- cious)	8.5	3.6	18.5	0.19
	Commodities (pro- duction)	9.1	4.2	19.3	0.22
Output inflation	North American break-even Inflation	4.7	-0.0	5.9	-0.03
	European break- even inflation	3.7	-1.2	5.4	-0.22
Other					
Liquid alternative risk premiums	Directional	7.6	2.7	3.7	0.73
	Relative long-short	7.3	2.3	4.5	0.51
	Macro rotation	9.8	4.8	8.6	0.56

Exhibit 6.5: Returns, excess returns, volatilities, and Sharpe ratios on ATP's factors. The table presents the annualized return, excess return, volatility, and Sharpe ratio, when asset classes are combined into factors.

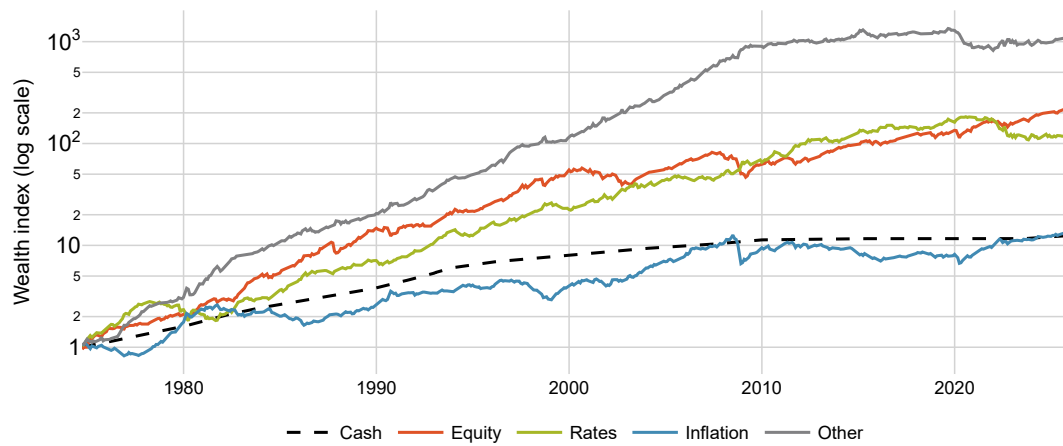
Asset or factor	Return (in pct)	Excess return (in pct)	Volatility (in pct)	Sharpe Ratio
Risk-free return				
Cash	4.9	-	1.2	-
Investable factors				
Equity	11.6	6.6	11.4	0.58
Rates	7.6	2.7	5.9	0.45
Inflation	5.4	0.5	5.9	0.08
Liquid Other	7.6	2.6	3.1	0.84

Time-varying factor returns

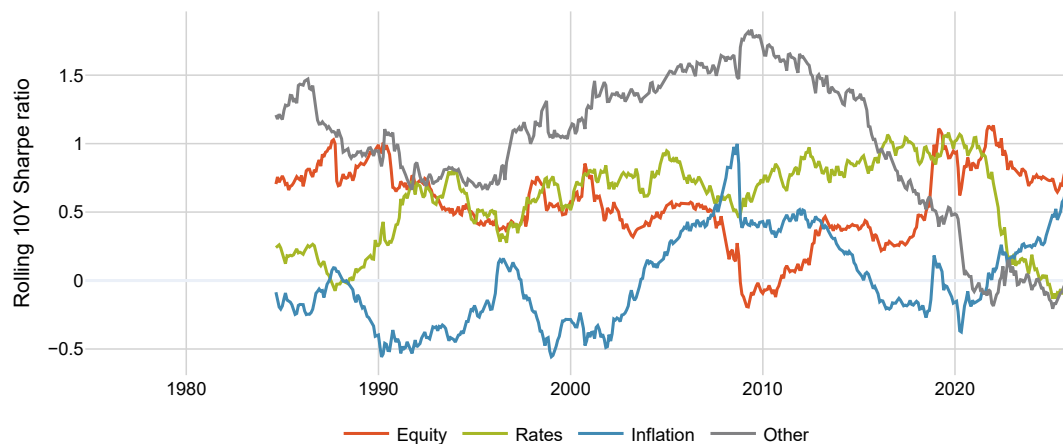
Returns on the factors are not earned simultaneously across time. Exhibit 6.6 reports the returns of the factors with a 10 pct target volatility. Panel (a) shows that the Equity factor and the Rates factor have approximately the same long-run cumulative return. The Other factor (or alternative risk premium strategies) has experienced relatively poor performance since 2010.

Review of ATP's Investment Strategy

Over the long run, the Inflation factor has delivered returns similar to a cash investment. Panel (b) reports 10-year rolling Sharpe ratios of the factors. The rolling Sharpe ratio of the Equity factor collapses during the Global Financial Crisis but sharply recovers after; the Rates factor has a rolling Sharpe runs between 0.5 and 1.0 from 1990 to 2022 but falls toward zero in inflationary episodes. It is precisely during those periods that the Inflation factor performs best in those episodes, clearly showing the benefit of holding the Inflation factor even though it has an overall Sharpe ratio close to zero. In particular, Exhibit 6.6, Panel (b) shows that the Inflation factor has performed well since 2020, which includes the Covid market crash, the subsequent inflation from affected global supply chains, and simultaneous equity and bond downturn in 2022.



(a) Factor cumulative returns

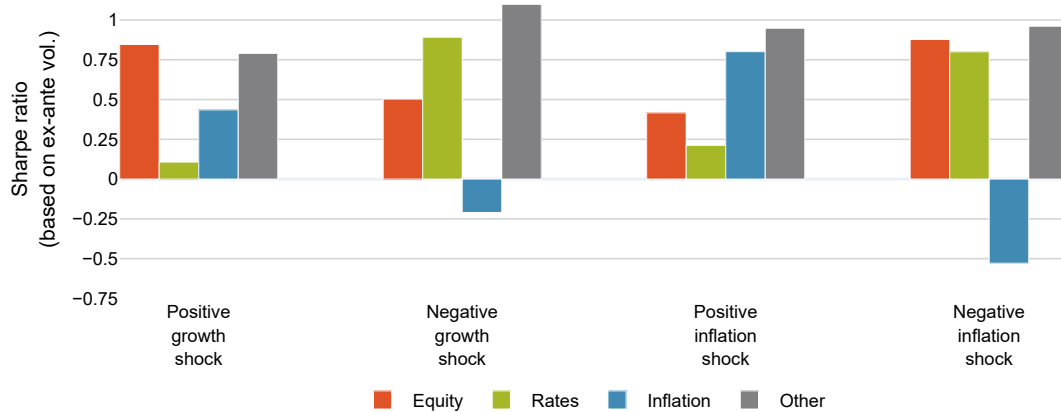


(b) Rolling Sharpe ratios of factors

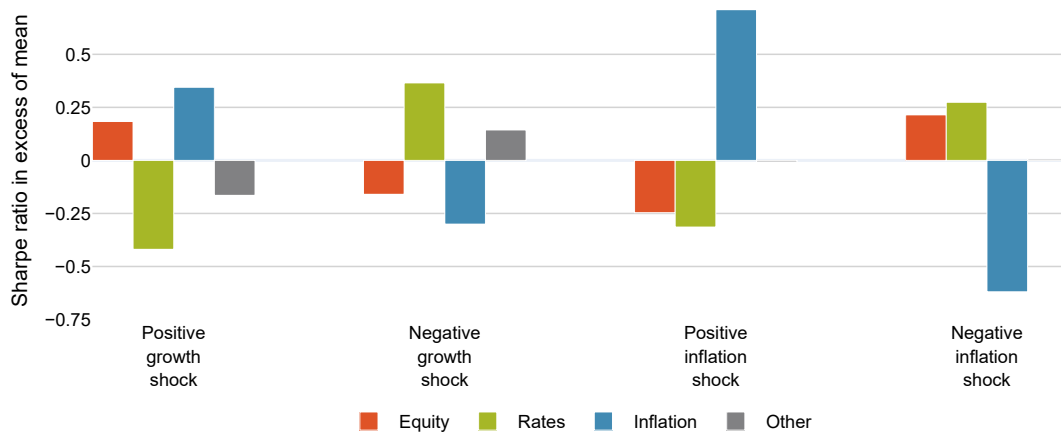
Exhibit 6.6: Returns and Sharpe ratios of ATP's factors. The figure illustrates the returns on ATP's factors when scaled to 10 pct ex-ante volatility. Panel (a) shows the returns on the factors, where the return on the cash account is shown for reference; Panel (b) shows the Sharpe ratios, when estimated on a 10-year rolling window.

Factor performance across macro regimes

Factors have different performance in different macro regimes, and these differing returns are diversifying over the long run. Exhibit 6.7 reports Sharpe ratios in absolute levels (Panel (a)) and as deviations from each factor's average (Panel (b)) across four different macro states defined by the sign of the surprise in year-on-year real GDP growth and year-on-year inflation against the trailing four-quarter average. Equity and Rates factors diversify each other. During positive inflation shocks, both Equity and Rates underperform—which happened in 2022 (see Section 7.2)—while the Inflation factor performs strongly, partly offsetting the loss on Rates. The Other factor does well across the different scenarios.



(a) Average Sharpe ratio in macro regime



(b) Difference from average Sharpe ratio

Exhibit 6.7: Risk-adjusted return for ATP's factors at positive or negative growth and inflation shocks. The figure illustrates the Sharpe-ratios for different macroeconomic surprises. Panel (a) shows the level of the Sharpe ratio within the given macroeconomic environment, where Panel (b) shows the difference between the Sharpe ratios in Panel (a) and the average Sharpe ratio across all four macro-economic environments.

6.3.3 Comparing factors with market capitalization benchmarks

ATP's four-factor portfolio differs materially from market capitalization-weighted benchmarks and has historically earned a higher return per unit of risk than 60-40 or levered 60-40 equity-bond portfolios. ATP's factor framework is not a relabeling of the global market portfolio. Each factor is deliberately constructed to achieve a desired economic exposure, be diversified geographically, and be implemented efficiently. This means that ATP's factors differ significantly from standard benchmarks like MSCI ACWI, the Bloomberg Global Treasury Index, the Bloomberg Commodity Index, or global credit-market weights.

Equity factor

ATP's Equity factor includes both listed equities and credit-spread exposure and hedges out the interest rate component of credit instruments. The latter is referred to as the Credit subfactor of the Equity factor. Implementation occurs through a Danish allocation and a global allocation. (We evaluate the Danish overweight position in Section 7.7.2.) Exhibit 6.8 shows that the Equity factor has a larger Danish allocation, a lower North American allocation, and more geographical balance than MSCI ACWI. ATP implements its Equity factor with cash equities and derivatives. The cash equity portfolio is also more equal-weighted than a capitalization-weighted index, while the equity futures are closer to market-cap implementation. As a result, the total equity exposure lies between an equal-weighted and market-cap-weighted approach. Exhibit 6.9 reports the implementation of the Credit subfactor. Panel (a) illustrates the geographical split of the Credit subfactor, and the split into Investment grade and high yield.⁷² Roughly one-third of the risk is in Investment grade exposure, one-third in high-yield exposure and the remaining one-third is Emerging market debt exposure. ATP is underweight exposure to North American credit, and overweight European and Emerging market credit but the overall the split between investment grade and high yield is in line with market-cap benchmarks.

⁷²For the Credit subfactor, only Emerging markets local currency debt and a very small fraction of the Investment grade bonds are implemented in cash bonds.

Review of ATP's Investment Strategy

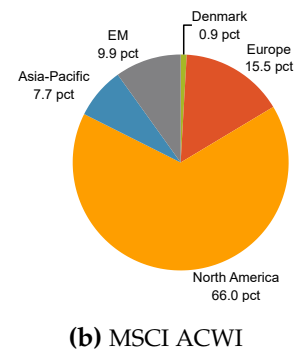
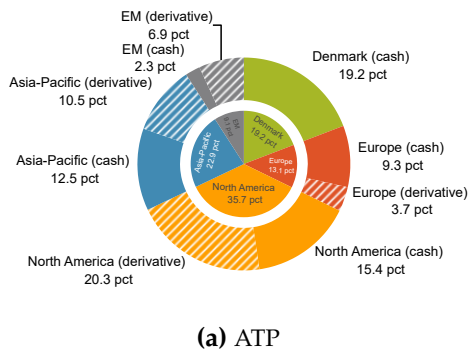


Exhibit 6.8: Geographical exposure in ATP's equity allocation compared to MSCI ACWI. The figure illustrates the geographical exposure of ATP's equity allocation in Panel (a) and MSCI ACWI in Panel (b). Derivatives are included using equity delta.

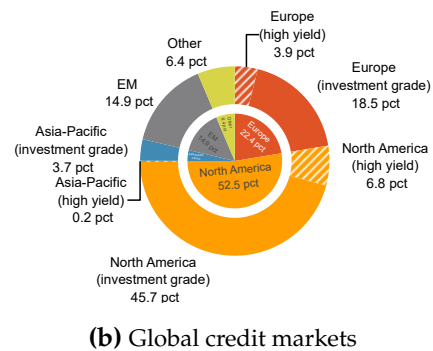
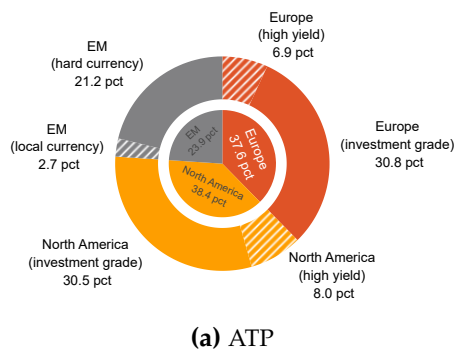


Exhibit 6.9: Geographical exposure in ATP's credit allocation compared to global credit markets. The figure illustrates the split of the credit exposure by geography and credit type (Investment grade, High yield, Emerging markets hard and local debt). The exposure for ATP in Panel (a) is based on spread duration, where the exposure for the Global credit markets in Panel(b) is based on market values.

Rates factor

ATP's Rates factor provides exposure to high-quality nominal interest-rate risk through government bonds, highly rated fixed-income instruments, and derivatives. Like the Equity factor, a high focus is placed on geographical diversification. Exhibit 6.10 illustrates the geographical breakdown of the Rates factor, which is similar to the geographical breakdown for the equity factor with two differences—European and Danish interest rate risk is largely interchangeable due to the currency peg and the share in North American rates is slightly lower, due to a higher interest rate volatility in North American interest rates compared to European interest rates. Relative to the Bloomberg Global Treasury Index, ATP has no exposure to Emerging market government debt (some exposure to Emerging markets credit is taken as part of the equity factor, discussed above), with larger allocation to Danish bonds and a lower allocation to North American bonds.

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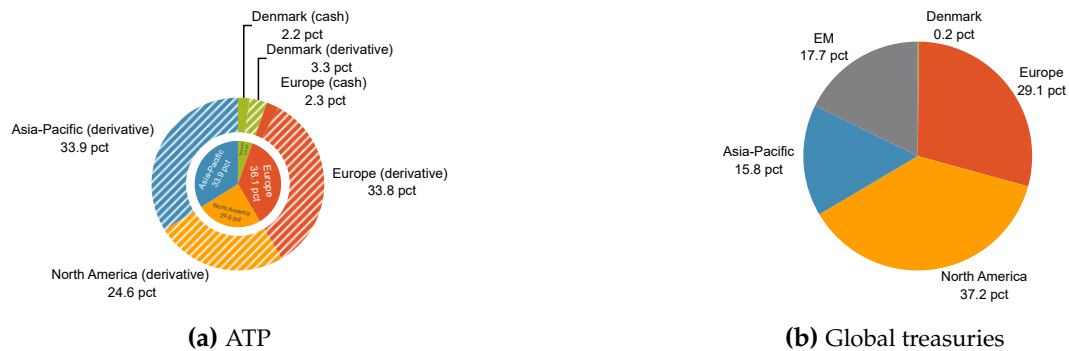


Exhibit 6.10: Geographical exposure for ATP's fixed income allocation compared to the Bloomberg Global Treasury Index. The figure illustrates the split of ATP's interest rate exposure by geography and implementation (cash or derivatives) in Panel (a) and the geographical split for the Bloomberg Global Treasury index in Panel (b). The exposure for both figures is calculated using interest rate duration.

Inflation factor

The Inflation factor consists of 50 pct input inflation, which is a broad selection of commodities, and 50 pct output inflation, which is exposure to realized inflation implemented through inflation swaps. Exhibit 6.11 reports the notional exposure for ATP's commodity implementation of input inflation in Panel (a) and the Bloomberg commodity index in Panel (b). ATP does not hold agricultural and livestock commodities, but does hold emission allowances. ATP puts approximately equal risk in each commodity, subject to liquidity considerations, producing an overweight to industrial metals and underweight to energy. Exhibit 6.12 contrasts the geographical exposure of ATP's output inflation (Panel (a)) to the geographical breakdown in the Bloomberg Global Inflation Linked Index (Panel (b)). The main difference is that ATP has a higher allocation to European break-even inflation, and no allocation in break-even inflation from Asia-Pacific (mainly Japan, Australia and New Zealand).⁷³

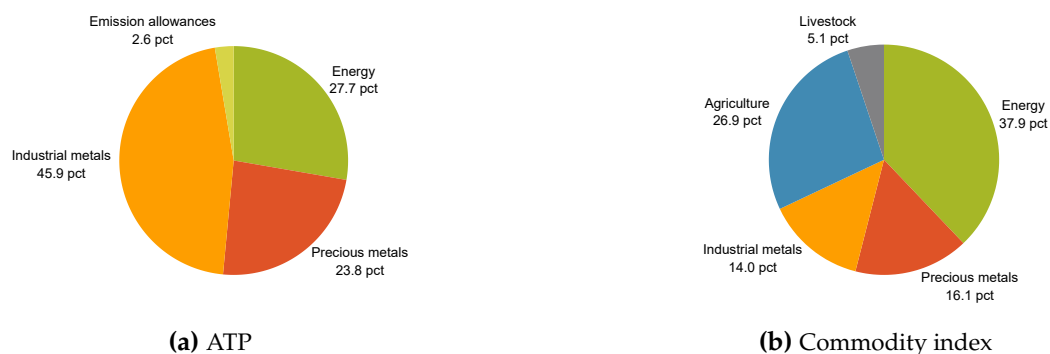


Exhibit 6.11: Main commodity group exposure in ATP's commodity allocation compared to the Bloomberg Commodity Index. The figure illustrates the split between main commodity groups for ATP's commodity implementation in Panel (a) and the Bloomberg Commodity Index in Panel (b). Both figures use notional as the exposure metric.

⁷³The European overweight in duration terms is partly due to a lower volatility level in European break-even inflation compared to North American break-even inflation.

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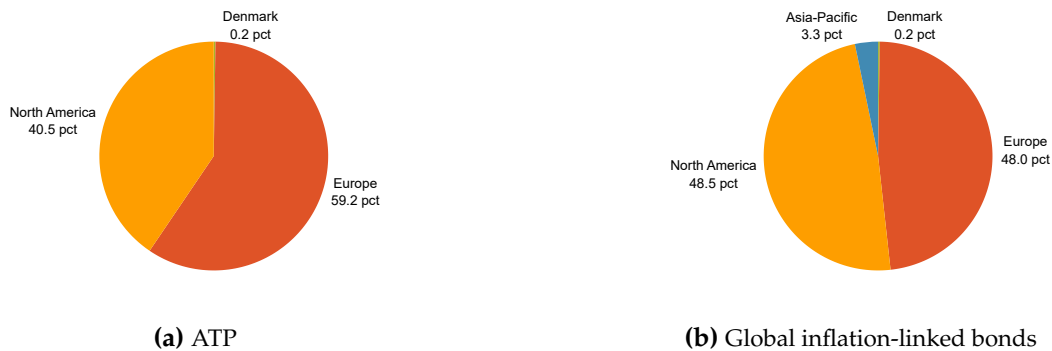


Exhibit 6.12: Geographical exposure in ATP's inflation swap and bond allocation compared to the Bloomberg Global Inflation-Linked Index. The figure illustrates the geographical breakdown in ATP's input-inflation sub-factor (Panel (a)) and the Bloomberg Global Inflation-Linked Index (Panel (b)). The exposure for ATP's portfolio is based on inflation duration, whereas the Bloomberg Global Inflation-Linked Index is based on market value.

Other factor

The Other factor consists of liquid risk premium strategies that are constructed to be beta-neutral to equity, rates, and inflation factors implemented in internal and external mandates. These strategies reflect risk premiums like carry and value that are reflected in different cross-sectional risk premiums (see Section 6.3.2) and also include defensive strategies that reduce overall risk in adverse market states. The latter includes a fast-reacting risk target strategy, and a more slowly reacting trend strategy. Exhibit 6.13 reports the risk allocation of the different types of strategies in the Other factor: there is a high allocation to defensive strategies, at roughly 70 pct of risk. The remainder are the cross-sectional risk premium strategies.

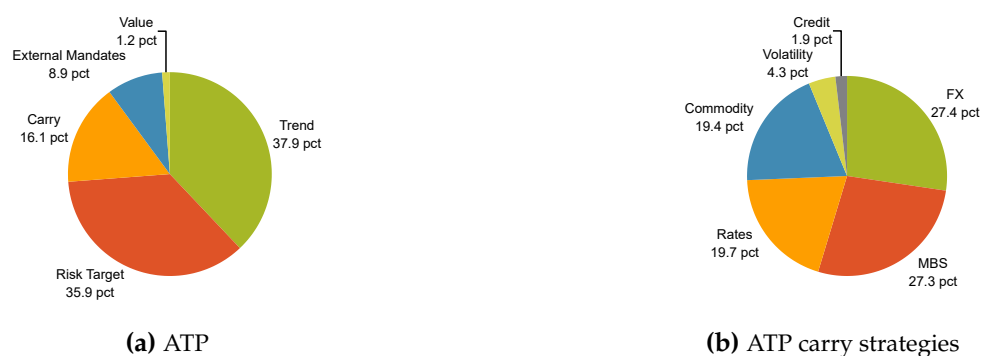


Exhibit 6.13: Composition of the Other factor. The figure illustrates the composition of the Other factor, where Panel (a) shows the risk shares across internal strategy-types and external mandates and Panel (b) shows the risk shares within the different carry-strategies. Exposures are based on the risk levels for each strategy.

In conclusion, the factor framework provides the economic building blocks for ATP's Risk-seeking Portfolios. The next step is determining how much risk should be allocated to each factor and sub-factor, which we turn to next.

6.3.4 Comparing factors to 60-40

The ATP four-factor portfolio materially improves the risk-return trade-off relative to a conventional 60-40 equity-bond portfolio. However, the implementation of the four-factor portfolio requires leverage, which we discuss in Sections 6.5–6.8 below (This is why the volatility of the raw factor strategy is 4.3 pct compared to 9.1 pct for a 60-40 portfolio).

For now, we show the factor portfolio has a substantially higher Sharpe ratio compared to the standard 60-40 portfolio, and this advantage is realized in approximately eight out of ten years. Exhibit 6.14 shows the Sharpe ratios of ATP's factor strategy and the 60-40 portfolio are 0.89 and 0.50, respectively. This leads to the factor strategy outperforming the 60-40 portfolio in 7 out of 10 years at a one-year horizon and 8 out of 10 years at a 10-year horizon. Scaling to the volatility of the 60-40 portfolio, ATP's factor portfolio is expected to outperform the 60-40 portfolio 74.6 pct of the time over multi-decade periods.

Exhibit 6.14: Comparing factors to 60-40 equity-bond portfolio. The table reports return summary statistics of a 60-40 equity-bond portfolio compared to ATP's four-factor portfolio. The numbers are shown without volatility scaling (raw), ex-ante scaled to have the same volatility as the 60-40 portfolio, and ex-ante scaled to have the same volatility as the ATP four-factor portfolio. Leverage is gross leverage, that is, including long-short positions in alternative risk premium strategies, which in practice are netted against the remaining factors. The sample period is 1973–2025.

	Raw		Scaled to 60-40 volatility		Scaled to ATP volatility	
	60-40	ATP factors	60-40	ATP factors	60-40	ATP factors
Mean return (pct)	9.6	8.6	9.6	13.9	20.1	34.5
Volatility (pct)	9.1	4.3	9.1	10.0	30.0	33.1
Sharpe ratio	0.50	0.89	0.50	0.89	0.50	0.89
Gross leverage	1×	1×	1×	2.4×	3.3×	8.0×
Prob(return > 0), 1Y (pct)	82.5	91.9	82.5	88.6	75.4	78.2
Prob(return > 0), 10Y (pct)	81.3	80.7	81.3	80.7	77.8	80.7
Prob(portfolio > 60-40), 1Y (pct)	0.0	33.2	0.0	65.8	69.1	71.5
Prob(portfolio > 60-40), 10Y (pct)	0.0	18.0	0.0	74.6	74.0	78.3

Scaled to ATP's risk level, the ATP four-factor portfolio beats the levered 60-40 portfolio with probability 71.5 pct over one year and 78.3 pct over 10 years. The economic interpretation is that ATP's factor framework is not simply a levered 60-40 portfolio; diversification across Equity, Rates, Inflation, and Other factor risk premiums raises the expected return per unit of

risk resulting in superior performance over long time horizons.

6.4 Required returns

Key message

ATP's required return on the Investment Portfolio is high relative to most institutional portfolios—around 17 pct per year, corresponding to a volatility target of approximately 30 pct per year. This is because the ambition to preserve the real value of guaranteed pensions must be funded out of a Bonus Potential that is much smaller than the Guaranteed Benefits.

Because risk on the Investment Portfolio is scaled as a percentage of the Bonus Potential, ATP's dynamic risk profile acts similar to Constant Proportion Portfolio Insurance (CPPI): when the balance on the Bonus Potential increases, the Investment Portfolio can take more absolute risk; when the Bonus Potential falls in value, risk is reduced to protect the guarantee floor.

ATP's implementation, however, is not a pure CPPI strategy. ATP maintains a minimum absolute level of risk when the Bonus Potential is low. The resulting risk profile has a "hockey stick" shape: risk declines as the funding ratio falls, but it does not fall all the way to zero when the funding ratio is near one. This makes ATP's strategy a hybrid between CPPI and constant-mix investing, preserving some return-seeking capacity even when the balance sheet is under pressure.

6.4.1 Required returns to meet the indexation ambition

Achieving the indexation objectives embedded in the ATP Act practically requires generating returns of approximately 17 pct per year. To understand this at a high level and ignoring the Market Return Portfolio and the Supplementary Hedge Portfolio, 80 øre of every DKK of contribution paid to ATP is allocated to a guaranteed benefit. Because the liabilities are hedged, this 80 øre is unable to bear investment risk. This leaves 20 øre of every DKK available to be invested in the Investment Portfolio. However, since the aim is to index all of the pension, the 20 øre of contribution allocated to the Investment Portfolio has to earn returns sufficient to cover indexation of the other 80 øre. Put simply, the 20 øre in the Investment Portfolio have to work four times as hard! Unless investment returns in the Investment Portfolio are extremely high, it is only possible to achieve the required return for indexing all pension benefits by taking leverage. Alternatively, if no leverage is taken, we should expect that only 20 øre out of every DKK—the unlevered allocation to the Investment Portfolio—can be indexed.

An analogy is buying a house. With only cash available, a family is limited in how much living space it can afford. But with a mortgage, that same cash can serve as a down payment, and the family enjoys a larger home for the same initial outlay. Of course, if there are fluctuations in housing prices, then the net worth of the family with the mortgage would be subject to greater volatility than the family making an all-cash purchase. The housing analogy is imperfect, however, although it shows the benefits and mechanics of leverage. ATP's use of leverage differs from a household because it is not capital-constrained: in principle, ATP could hold the same dollar exposure to risk-seeking assets without leverage by reducing its Interest Rate Hedge Portfolio. ATP uses leverage because it must simultaneously hedge the guaranteed pensions and take investment risk on the same balance sheet with an aim to meeting the inflation indexation on the guaranteed pensions.

The required return on the Investment Portfolio can be decomposed into three components: (1) maintaining the current funding ratio, (2) generating additional returns to reach the target funding ratio for bonus allocation, and (3) covering investment costs. These are presented in detail below.

(1) Maintaining the funding ratio

The funding ratio is the ratio of assets (Interest Rate Hedge Portfolio plus Investment Portfolio—when still ignoring the Market Return Portfolio and the Supplementary Hedge Portfolio) to liabilities. Suppose the funding ratio is 120 pct—this means that for every kroner of liabilities, the Interest Rate Hedge Portfolio and the Investment Portfolio together hold DKK 1.20. To keep this ratio constant, both the Interest Rate Hedge Portfolio and the Investment Portfolio must grow at the same rate as liabilities. Suppose that the liabilities are growing at approximately 3 pct per year (the sum of a 2 pct short-term interest rate and a 1 pct term premium). Thus, meeting the guarantees means we start with the Investment Portfolio generating approximately 3 pct before tax, or roughly 2.5 pct after tax.

So far, we have just met the nominal guarantee on the liabilities *without* indexation. To achieve indexation, we need to increase the funding ratio.

(2) Increasing the funding ratio

ATP has historically allocated bonuses when the funding ratio exceeds 120 pct. Increasing the funding ratio requires the Investment Portfolio to increase more than the Interest Rate Hedge Portfolio (which increases one-to-one with the liabilities). To allocate a 2 pct bonus, the funding ratio must rise from 120 pct to 122 pct. We assume this extra 2 pct comes from additional investment returns, and not leverage.

Because the Investment Portfolio is roughly 20 pct of liabilities, generating a 2 pct point increase in the funding ratio requires a 10 pct return on the Investment Portfolio ($2 \text{ pct} \times 100 \text{ pct} / 20 \text{ pct}$). However, this 10 pct return is not enough. When the bonus is paid, there is a transfer of money from the Investment Portfolio to the Interest Rate Hedge Portfolio. The liabilities have increased, the Interest Rate Hedge Portfolio has increased one-to-one with the increase in the liabilities, and the transfer from the Investment Portfolio to the Interest Rate Hedge Portfolio, by construction, decreases the amount of the Investment Portfolio. This causes the funding ratio to drop below 120 pct.

In order to restore the funding to 120 pct, we require more than a 10 pct return on the Investment Portfolio. In this case, we require an additional 2 pct = $10 \text{ pct} \times (120 \text{ pct} - 100 \text{ pct})$ to restore the buffer. More details of this with an illustration of the bonus payment in 2021 is covered in Section 5.4.6.

(3) Covering costs

The administration and investment cost excluding performance fees amounts to approximately 0.2 pct per annum relative to assets under management. (Section 7.7.8 investigates ATP's costs in detail.) However, the investment return is generated on the Investment Portfolio, not the whole balance sheet. So, to generate 0.2 pct on the balance sheet, the Investment Portfolio must generate $120 \text{ pct} / 20 \text{ pct} \times 0.2 \text{ pct} = 1.2 \text{ pct}$.

Total return requirement

Adding up the elements in (1) to (3) above gives a required return of 16.5 pct before tax as seen in the table below.

Item	Return (pct)
Return on liabilities after tax	2.5
+ Return after tax to increase the funding ratio from 120 pct to 122 pct	10.0
+ Return after tax to keep the funding ratio at 120 pct	2.0
+ Investment costs	1.2
= Required total return after tax	15.7
⇒ Required total return before tax (PAL tax rate is 15.3 pct)	18.5
⇒ Required excess return before tax (short rate is 2.0 pct)	16.5

The 16.5 pct required excess return before tax corresponds to 14 pct after tax.⁷⁴ This is the

⁷⁴We have excluded the Market Return Portfolio and SAP in this calculation. The size of the Market Return Portfolio has a substantial impact on required returns. However, currently it only takes up around 1 pct of pension liabilities and is therefore practically irrelevant.

required excess return before tax net of any performance fees paid to external managers.

(4) Covering tax asset

There is one more item that affects required returns, which is ATP's tax asset. This is approximately 6 pct of AuM and is an amount receivable towards the Danish state. It stems from the losses on the Interest Rate Hedge Portfolio when interest rates rose by 3 percentage points. The Danish state does not refund tax deficits but instead provides ATP with a right to deduct the loss from future positive returns in the tax statement. ATP has effectively provided a loan to the Danish state, and it is perpetual in ATP's case. Since no interest is paid by the state to ATP, there is an opportunity cost of roughly 0.7 pct ($2 \text{ pct short rate} \times 6 \text{ pct} \times 120 \text{ pct} / 20 \text{ pct}$). When the cost of the tax asset is included, we have:⁷⁵

Required excess return before tax = 17.2 pct.

(5) Including the Market Return Portfolio and the Supplementary Hedge Portfolio

In the calculation of the required return above, we have excluded the Market Return Portfolio and the Supplementary Hedge Portfolio but including them, the total excess required returns are approximately 12.3 pct before tax and 10.4 pct after tax. The size of the Market Return Portfolio has a substantial impact on required returns because it is designed to hold assets with high risk over the long term (Section 5.5.4). However, currently it only takes up around 1 pct of pension liabilities and is therefore practically irrelevant. Hence, the reduced required excess return stems mainly from the inclusion of the Supplementary Hedge Portfolio. The Supplementary Hedge Portfolio on average earns an additional return, which lowers the required return for the Investment Portfolio.

Required excess return before tax = 12.3 pct.

6.4.2 Leverage is necessary

ATP cannot achieve the required return of approximately 17 pct before tax in the calculation above without taking leverage. The required return is far above the capital market assumptions of a global equity portfolio, which is around 6.5 pct. Achieving a return of 17 pct requires leveraging an equity portfolio by more than 2 times. The volatility of the all-equity portfolio is 15 pct, giving a reward-to-risk ratio of 0.3 (assuming a cash rate of 2 pct).

While the mean-variance efficient portfolio obtains a superior reward-to-risk ratio of 0.36 (see the capital market assumptions in Section 4.4.1), larger leverage is required to scale the mean-

⁷⁵We ignore the tax asset in the succeeding sections and only focus on the items that are integral parts of the ATP business model.

variance efficient portfolio to the level of ATP's required return compared to an all-equity portfolio. It should be recalled from Section 4.4.1 that the mean-variance efficient portfolio is 62 pct bonds and 38 pct equities. This portfolio has a mean return of 4.4 pct and volatility of 6.8 pct; the corresponding reward-to-risk ratio of the efficient portfolio is 0.36, which is greater than the reward-to-risk ratio of the all-equity portfolio of 0.3.⁷⁶

Diversification leads to a higher risk-return trade-off but it also decreases the risk of the efficient portfolio, and this leads to ATP requiring more leverage on the efficient portfolio than on an all-equity portfolio to meet its required return. The intuition is that the efficient portfolio holds both bonds and equity which leads to lower volatility than an all-equity portfolio. Diversification implies that for each unit of risk, the investor obtains a higher return in the efficient portfolio than in the all-equity portfolio. But since the efficient portfolio has a lower volatility per unit of capital, the required notional exposure on the efficient portfolio is larger. The amount of leverage required to hit ATP's 17 pct required return is 6× applied to the efficient portfolio. This is a high level of leverage relative to most institutional portfolios and reflects the combination of ATP's high required-return target and the low intrinsic volatility of its risk-balanced, diversified efficient portfolio. The leverage is structurally feasible because of ATP's use of derivatives, the internal funding provided by the Interest Rate Hedge Portfolio, and ATP's treasury function (Section 6.2.3). We discuss the implementation of leverage in Section 6.6.

The benefit in applying more leverage to the efficient portfolio compared to taking lower leverage in an all-equity portfolio is that diversification lowers the probability of large losses for a given expected return. In other words, leverage increases exposure, but diversification improves the quality of that exposure. Leveraging the efficient portfolio means the same return target can be pursued with less dependence on a single source of return, resulting in lower downside risk and a lower probability that losses exhaust the Bonus Potential.

In short, taking leverage is necessary to meet ATP's combination of nominal guarantees, the ambition to further index the tariffs, and the limited size of the contributions to the Bonus Potential relative to the Guaranteed Benefits. In practice, ATP uses more sophisticated risk metrics than volatility, which are Expected Shortfall measures but the intuition is the same—which we discuss in Section 6.5.

⁷⁶Historical estimates given in Exhibit 6.5 are higher than the conservative capital market assumptions. In addition, the factor portfolio includes both the inflation factor and the alternative risk premiums, yielding a higher Sharpe ratio.

6.4.3 Dynamic risk profile

ATP's risk-seeking architecture combines an Interest Rate Hedge Portfolio, which serves as the risk-free asset against the guarantees, where the remaining investment risk is taken through the Risk-seeking Portfolios. In its simplest form, this is a Constant Proportion Portfolio Insurance (CPPI) strategy in the sense of Section 4.1.6: as the funding ratio falls, the cushion Bonus Potential shrinks and the absolute amount of risk-taking also falls. Viewed at the total balance-sheet level, the strategy is procyclical—risky exposure rises with the funding ratio and falls when it declines.

Three features of ATP's implementation moderate that procyclicality:

- *The Supervisory Board has set a minimum absolute risk level for the Investment Portfolio when the Bonus Potential is low.* In those states, ATP does not automatically continue reducing risk in proportion to the Bonus Potential; instead, the Supervisory Board can maintain a floor under risk-taking in order to preserve long-term return generation.
- *Bonus distributions reduce the Bonus Potential after strong investment outcomes, moving value out of the risk-bearing cushion and into higher pension rights.* This creates a countercyclical effect so that when returns are high, there is a rebalancing away from risky assets into risk-free assets backing the liabilities.
- *The Supplementary Hedge Portfolio keeps a constant risk level tied to the Guaranteed Benefits rather than to the Bonus Potential.* For a given level of interest rates, the Supplementary Hedge Portfolio therefore contributes a more stable level of absolute risk across different funding ratio outcomes, in both positive and adverse scenarios.

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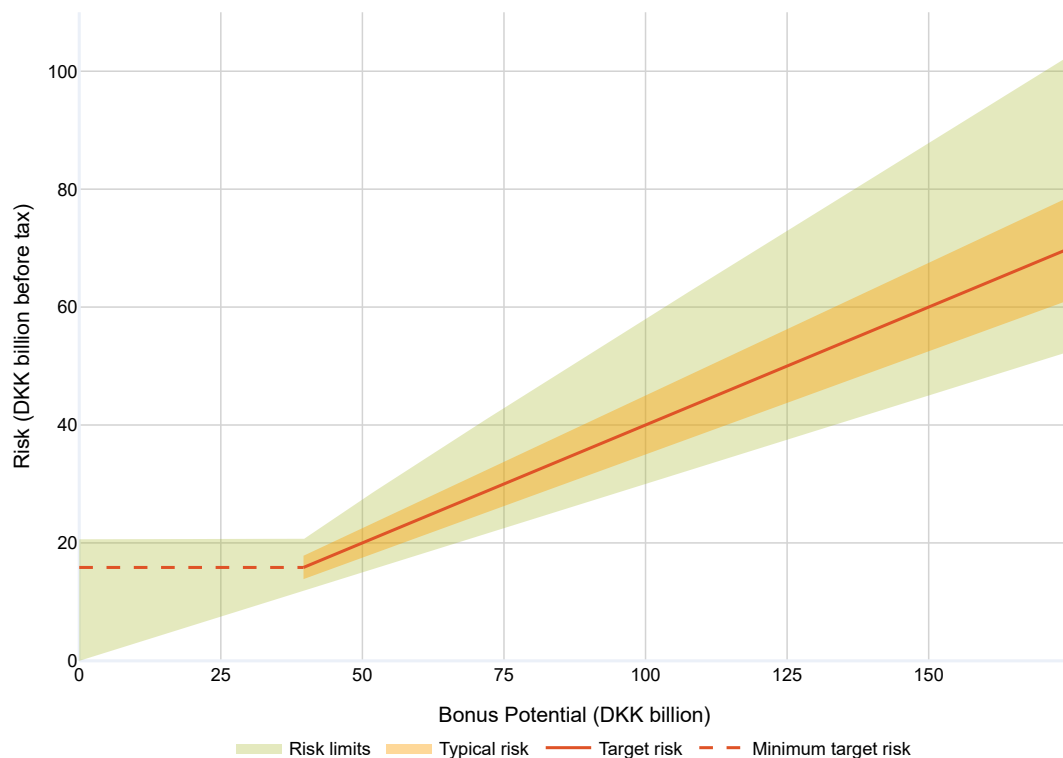


Exhibit 6.15: Risk in the Investment Portfolio as function of the funding ratio. At higher funding ratios above 105 pct the investment risk is scaled linearly, that is, constant relative risk, whereas for low funding the ratios the risk is kept at a constant level in order to not be a forced seller of assets. The green area is the limits given by ATP's Supervisory Board (the upper part corresponds to an after tax total risk equal to 50 pct $\times$ BP) where the lower part is equal to 30 pct $\times$ BP before tax. The orange area ("Typical risk") show the typical risk limits wherein ATP's daily management operates.

Exhibit 6.15 illustrates the dynamic risk profile follows a "hockey stick" shape. The central line shows the target risk level that ATP would normally follow as the funding ratio changes: for funding ratios above 105 pct (corresponding to a Bonus Potential of approximately DKK 30–40 billion as of end of 2025) as the funding ratio rises,⁷⁷ the Bonus Potential is larger and the Investment Portfolio can take more absolute risk. Around this target is an operating band within which the investment staff typically manage day-to-day implementation. Outside that band are Supervisory Board-defined limits. At low funding ratios, however, there is a minimum level of risk, so the risk profile bends into a "hockey stick." This creates higher risk relative to the remaining Bonus Potential in low funding ratio states, but it also preserves some ability to earn returns when the balance sheet is under pressure.

⁷⁷The funding ratio is an outcome of ATP's balance sheet rather than a direct investment choice. Bonus allocations convert part of BP into higher guaranteed pension rights, reducing the funding ratio but increasing members' guaranteed pensions. Section 5.4.6 covers bonus mechanics in more detail.

6.5 Risk appetite

Key message

ATP sets risk appetite through the balance sheet items that absorb gains and losses. The Supervisory Board defines the aggregate risk tolerance in terms of Expected Shortfall, ES(99 pct, 3M), which is the average loss in the worst 1 pct of outcomes over a three-month horizon. The risk is set in terms of the Bonus Potential, the buffer that absorbs investment gains and losses with the maximum aggregate tolerance of 50 pct of the Bonus Potential after tax. The risk targets for the Investment Portfolio, the Market Return Portfolio, and the Supplementary Hedge Portfolio are then tied to the specific balance sheet items that bear the returns from each portfolio.

This structure makes ATP's risk appetite different from a conventional strategic asset allocation which is based on fixed equity-bond benchmarks. At the Supervisory Board's maximum tolerance, ATP's risk position corresponds roughly to a Solvency II coverage ratio of 103–104 pct. In normal conditions, actual risk consumption is typically around 70 pct of the Supervisory Board limit, corresponding roughly to a Solvency II coverage ratio of 140–150 pct.

Measured against AuM, ATP's risk is comparable to a low to medium-risk pension product. Measured against the Investment Portfolio ATP operates at a very high level of risk. The Investment Portfolio's 30 pct volatility sits at the upper end of the institutional investor distribution and in the territory of the highest volatility individual hedge funds. This structure reflects the trade-off between preserving solvency and generating enough return to support future bonus allocations.

ATP's risk appetite is set by translating the return required to sustain the pension promise into a Supervisory Board-approved amount of balance-sheet risk, subject to the constraint that the guarantee remains robust under adverse scenarios. The previous sections have separated the guaranteed liabilities from the return-seeking balance sheet, identified the factors ATP uses to harvest compensated risks, and shown that the required returns are high. This section explains how ATP determines how much risk to take and how that risk is expressed through the different portfolios.

6.5.1 Risk measures and Supervisory Board risk tolerance

The Supervisory Board sets ATP's aggregate risk tolerance for the fund as a whole, and defines a total risk budget, after tax as the maximum risk ATP is willing to accept. Risk is expressed using Expected Shortfall (ES) with a 99 pct confidence level over a three-month horizon, with

the shorthand notation of ES(99 pct, 3M)—see Appendix D for further details. This measure represents the average expected loss, across all losses in the lowest 1 pct probability mass of the distribution. The measure assumes an instantaneous shock, that is, no portfolio rebalancing or other management actions. This common metric allows ATP to aggregate different sources of risk (market, insurance, and operational risk) into a single measure of potential loss.

The total maximum risk budget, after tax, is currently set as 50 pct on the Bonus Potential, with a minimum threshold of DKK 20 billion. The threshold means that ATP does not mechanically reduce risk tolerance to zero when BP is low; instead, the Supervisory Board is willing to maintain a minimum absolute risk budget, even though this implies higher risk relative to the remaining BP in adverse states when the BP is low. Before risk is allocated to the Investment Portfolio, ATP deducts non-investment risks, counterparty risk, and profit-and-loss risk from the Interest Rate Hedge Portfolio. The remaining capacity is the risk budget available for investment risk. The Supervisory Board therefore sets both the overall maximal risk tolerance and the main portfolio-level risk framework, while ATP's daily management implements the exposures within those mandates.

The Investment Portfolio carries the highest risk because it is the main vehicle through which ATP seeks to create returns that can support future bonuses. Its strategic target is 40 pct of the Bonus Potential, measured as ES(99 pct, 3M) before tax, which corresponds roughly to an annual volatility target of about 30 pct. When the Bonus Potential is low, ATP does not mechanically reduce the Investment Portfolio's risk to zero. Instead, ATP enters recovery mode, triggering Supervisory Board involvement in order to make decisions balancing short term safety and long-term objectives with a minimum risk threshold of DKK 20 billion. (See also Section 6.4.3.) The Supervisory Board believes this policy supports long-term value creation for the members of ATP.

6.5.2 Risk mandates

ATP's risk appetite is implemented through balance-sheet vehicles for which mandates are tied to the pension product. This differs from the standard institutional practice, where the asset owner typically sets an objective and risk appetite through a strategic asset allocation or reference portfolio, and the investment organization then implements exposures within that benchmark and associated risk limits (see Sections 4.4.1 and 4.5.5).

Briefly, ATP's three Risk-seeking Portfolios are each linked to a specific liability-side item, as discussed in Section 5.5.4. The Investment Portfolio (INV) is linked to the Bonus Potential (BP), which is the collective buffer that absorbs investment gains and losses and supports future bonus allocations. The Market Return Portfolio (M) is linked to the reserve for the Life Annu-

ity with Market Exposure (H_m), where returns accrue directly to members with this product component. The Supplementary Hedge Portfolio (SAP) is linked to Guaranteed Benefits measured without the reserve obtained from discounting Guaranteed Benefits with the illiquidity spread, the Long-term Supplementary Reserve (LSH), and is designed to earn a return above the guaranteed rate while using risk capacity associated with that liability base. Section 5.5.4 describes these balance sheet items and portfolio links in more detail.

The Market Return Portfolio (M) and The Supplementary Hedge Portfolio (SAP) are consequences of the new business model. Section 5.5.6 describes the introduction of the new business model, and its new liability items and portfolios. The risk levels of the portfolios are dictated by their purpose, their risk budget and their potential impact on the Bonus Potentials, but ultimately their interaction on the total pension benefit. Thus, risk levels (and the share of the illiquid pool fund, see Section 6.7.2 below) reflect long-dated investments due illiquid liabilities (SAP) and a market-rate product (M). Exhibit 6.16 describes the purposes and potential impact on the Bonus Potential of the portfolios.

ATP translates risk appetite into portfolio mandates by assigning each Risk-seeking portfolio a risk target tied to the balance-sheet item that bears its gains and losses. Exhibit 6.16 summarizes this mandate structure across ATP's main portfolios, showing for each portfolio its purpose, where net returns are allocated, the relevant risk target, and the equity-equivalent exposure implied by that target. The Investment Portfolio has a target risk of 40 pct of BP, measured as ES(99 pct, 3M) before tax, with a minimum risk level of DKK 20 billion; this high relative risk target reflects that BP is the main collective buffer available to generate returns for future bonus allocations. The Market Return Portfolio has a target risk of 16 pct of H_m , which broadly corresponds to a medium-risk market-rate product. The Supplementary Hedge Portfolio has a target risk of 2.5 pct of GY, reflecting a smaller but more stable risk allocation tied to the Guaranteed Benefit base; its role is to earn returns above the guaranteed rate while limiting the probability that losses ultimately need to be absorbed by BP. In this way, ATP aggregates risk appetites into separate investable mandates whose scale and risk tolerance depend on the liability item.

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Exhibit 6.16: ATP portfolio mandates, risk anchors, and return allocation. Risk targets are before tax unless otherwise stated.

Purpose	Net return allocated to / residual risk	Risk target	Board risk limit	Equity- equivalent allocation
Interest Rate Hedge Portfolio (AFD)				
Hedges cash flows associated with guaranteed benefits; ATP's risk-free asset for the guarantees.	Bonus Potential (BP); small residual risk on BP.	100 pct hedge ratio.	Board hedge-ratio limits close to 100 pct; wider key-rate and curve limits.	0 pct $\times$ GY.
Market Return Portfolio (M)				
Generates a return comparable to a medium-risk market-rate product.	Reserve for Annuity with Market Exposure (H_m); no residual risk on BP.	16 pct $\times H_m$.	Board limits around target; implementation variation only.	80 pct $\times H_m$.
Supplementary Hedge Portfolio (SAP)				
Generates return above the guaranteed rate earned on the Interest Rate Hedge Portfolio and supports higher long-term bonuses.	Initially Long-Term Supplementary Reserve (LSH); ultimately low residual risk on BP.	2.5 pct $\times$ GY.	Board limits around target; implementation and phase-in variation only.	12.5 pct $\times$ GY.
Investment Portfolio (INV)				
Generates long-term returns so ATP can allocate bonuses to members.	Bonus Potential (BP); large residual risk to BP.	Max[40 pct $\times$ BP; DKK 20 billion].	30 pct $\times$ BP before tax lower limit; upper limit corresponds to total after-tax Board tolerance of 50 pct $\times$ BP.	200 pct $\times$ BP.

The Supervisory Board's risk limits, also reported in Exhibit 6.16, are much higher than the strategic risk targets. ATP's Supervisory Board has set a risk tolerance, which implies that ATP is willing to have losses—no matter the source—equal to 50 pct of the Bonus Potential

after tax as measured by ES(99 pct, 3M). Compared to Solvency II, which measures the risk as 99-pct Value-at-Risk on a one-year horizon, the risk tolerance of the Supervisory Board can be approximated as $1.93 \times \text{ES}(99 \text{ pct}, 3\text{M})$.⁷⁸ The risk tolerance is equal to 96.6 pct of the Bonus Potential, when ignoring portfolio rebalancing at the 1-year horizon. If ATP adheres to the risk tolerance set out by the Supervisory Board, it will be solvent using a Value-at-Risk similar to Solvency II (but not by a large margin—it corresponds to a Solvency ratio of 103 pct). Typically, the actual risk consumption is approximately 70 pct of the Supervisory Board limit, which corresponds to a solvency ratio around 150 pct. When BP is low, however, a minimum absolute threshold of DKK 20 billion may bind. In those states, the risk budget is no longer mechanically capped at 50 pct of BP; instead, ATP deliberately maintains some absolute risk-taking capacity, which is one reason the dynamic risk profile has the hockey stick shape described in Exhibit 6.15.

The Supervisory Board risk limits are also based on asset liability management (ALM) analysis, and thus not solely focused on reaching the inflation indexation ambition in the ATP Act. The ALM considers multiple objectives, such as the expected pensions and pension-at-risk for different member cohorts, the risk of a low Bonus Potential and the likelihood of generating bonuses in excess of inflation. Thus, the Supervisory Board does not solely reverse-engineer a risk target to meet the inflation indexation ambition, but also considers other multiple factors, when deciding on a risk level. We evaluate the ALM analysis in Section 7.4.

The risk mandates are illustrated in a return risk diagram in Exhibit 6.17. While the Supplementary Hedge Portfolio adds some risk and hence expected returns, the bulk of risk still sits within the Investment Portfolio. As the Market Return Portfolio is slowly growing, it will take some time before ATP reaches its long-term target risk in the new business model. When fully phased in, the risk on the balance sheet will correspond to a risk moderately below an average market risk product (see Section 4.6.2).

⁷⁸There are methodological differences between ATP's risk model and Solvency II, such as longevity risk, market risk, and aggregation of different risk categories, making this comparison inexact.

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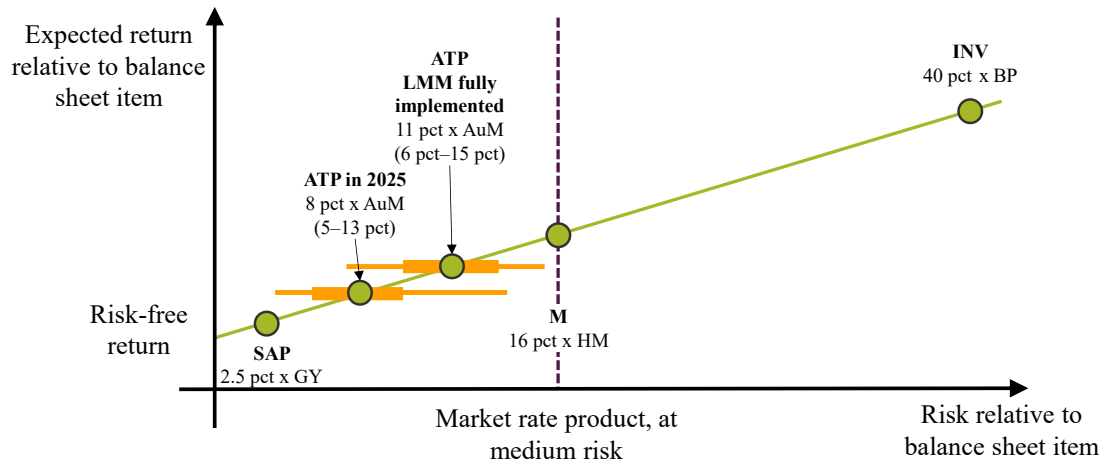


Exhibit 6.17: Overall risk in ATP's product. The line represents ES(99 pct, 3M) risk from Risk-seeking Portfolios and excludes the risk on the balance sheet from the Interest Rate Hedge Portfolio.

6.5.3 Implications of the risk mandates

ATP's risk mandates require structural leverage because the risk-bearing portfolios must generate returns for a balance sheet dominated by guaranteed liabilities. ATP implements the leverage through derivatives rather than cash market borrowing. Exhibit 6.18 illustrates this using a stylized balance sheet allocation as a function of the funding ratio, assuming that the reserve for the Life Annuity with Market Exposure (H_m) has a 5 pct share of pension liabilities, which is the expected steady state about a decade after the introduction of the new business model. At a steady-state funding ratio of 120 pct, ATP's equity-equivalent allocation is 47 pct of AuM while the implied cash position is about –26 pct of AuM. The negative cash position represents the amount of leverage. (Technically, the negative cash position is the minimum leverage required if all risk-seeking exposure were implemented through beta-one equity exposure.)

In practice, ATP does not implement the Risk-seeking portfolio as an all-equity portfolio and instead runs a diversified, risk-balanced portfolio with substantial exposure to Rates, Equities, Inflation, and Other (or alternative risk premiums) factors which have lower volatility. Reaching the same risk target with these lower volatility exposures requires more notional exposure and therefore more leverage. The funding base is the architecture of the Interest Rate Hedge Portfolio (Section 6.2): hedging part of the Guaranteed Benefits through interest rate swaps creates long-dated exposure without consuming the same cash as a fully physical bond hedge. This leaves available funding from cash and hedge swaps, which have positive values in Exhibit 6.18. These positions are notably larger when ATP is under pressure than when it is wealthy. We discuss the mechanics of leverage in more detail below in Section 6.6.3.

Exhibit 6.18: ATP stylized asset allocation between hedge assets and speculative assets. The numbers assume speculative assets are invested in equities (or with equity equivalent cash consumption). The figure also shows the volatility of the allocation when assuming a 15-year duration on the liabilities, as well as the volatility of the risky assets when seen in isolation, that is, treating the hedge as the risk-free asset. The expected return is based on Exhibit 4.8. For comparison a 60-40 portfolio earns 6.5 pct, or 6.7 pct if the bond allocation is invested at the same return as the Interest Rate Hedge Portfolio.

Funding ratio (pct)	100	105	110	115	120	125	130
Panel (a): Balance sheet (pct of AuM)							
GY(<i>m</i>)	95.0	90.5	86.4	82.6	79.2	76.0	73.1
H _m	5.0	4.8	4.5	4.3	4.2	4.0	3.8
BP	0.0	4.8	9.1	13.0	16.7	20.0	23.1
Panel (b): Equity equivalent allocations in portfolios (pct of AuM)							
M	4.0	3.8	3.6	3.5	3.3	3.2	3.1
SAP	11.9	11.3	10.8	10.4	9.9	9.5	9.2
INV	13.3	12.7	18.2	26.2	33.4	40.1	46.3
Panel (c): Allocations (pct)							
Cash	−24.2	−18.3	−19.1	−22.6	−25.8	−28.8	−31.6
Hedge swaps	47.5	45.2	43.2	41.3	39.6	38.0	36.5
Hedge bond	47.5	45.2	43.2	41.3	39.6	38.0	36.5
Total equity equivalent	29.2	27.9	32.7	40.0	46.7	52.8	58.5
Available funding (Cash + Hedge swaps)	23.3	26.9	24.1	18.7	13.7	9.2	4.9
Panel (d): Volatility (pct of AuM, before tax)							
Incl. Interest Rate Hedge Portfolio	11.6	11.0	10.9	11.1	11.3	11.7	12.0
Excl. Interest Rate Hedge Portfolio	4.4	4.2	4.9	6.0	7.0	7.9	8.8
Panel (e): Expected return (pct, before tax)							
Expected return on AuM	5.2	5.1	5.3	5.7	6.1	6.4	6.7

The 30 pct volatility risk target for the Investment Portfolio can be interpreted as a moderate or a very high level of risk depending on which denominator is used. Using the level of AuM as the denominator, ATP runs at approximately 11–12 pct annualized volatility (5–8 pct if the Interest Rate Hedge Portfolio is excluded), squarely in the territory of a low to medium-risk market-rate product. The expected return on AuM at ATP's typical funding ratios of 115–125 pct is 6.3–7.0 pct per year, comparable to a 60-40 equity-bond portfolio at 6.5–6.7 pct—but with a guarantee and longevity protection that the 60-40 portfolio does not provide. Using the Bonus Potential as the denominator, the same risk-seeking exposure runs at approximately 30 pct annualized volatility. The first denominator is more appropriate to use when comparing

ATP to other institutional balance sheets; the second is more appropriate when comparing the investment activity itself to other stand-alone investment vehicles that are also measured against their own capital.

ATP runs a very high level of risk taken in the Investment Portfolio, at around 30 pct volatility, which is at the very high end of the institutional-investor distribution. Conventional balanced 60-40 portfolios have an annualized volatility of approximately 10 pct (see Section 4.4.1 for empirical estimates). In fact, since all funds hold less than 100 pct equity and the equity allocation is often the allocation with the highest level of risk, most institutions have volatility less than 12 pct. Most Danish pension funds' market-rate products have around 10–12 pct volatility (Section 4.6.2). By contrast, ATP's Investment Portfolio target of 40 pct of BP in ES(99 pct, 3M) corresponds to roughly 30 pct annualized volatility. Measured against the capital that absorbs investment losses, ATP is therefore operating at the high end of institutional risk-taking, even though the total balance-sheet risk measured against AuM is much lower.

ATP's risk target levels are very high relative to hedge funds. A recent study of hedge funds by [Antoniadis and Skouras \(2026\)](#) reports the average and median annualized hedge fund volatilities as 17.2 pct and 12.6 pct, respectively. [Ang, Gorovyy, and van Inwegen \(2011\)](#) document that individual hedge funds use leverage to scale returns to target volatility levels, and that the upper part of the cross-sectional distribution of individual hedge-fund volatilities reaches roughly 30 pct annualized in stressed periods. The Investment Portfolio's 30 pct target therefore sits in the territory of the highest-volatility individual hedge funds, not in the territory of pension funds. The difference between ATP and those hedge funds is structural: at ATP the high-volatility investment activity is one component of a balance sheet whose other components—the fully hedged guarantee book, plus the Supplementary Hedge Portfolio and the Market Return Portfolio—keep AuM-level risk at conventional pension-fund levels.

The risk in the Investment Portfolio is extremely high compared to actively managed long-biased funds. Most active equity funds are benchmarked on a beta-one portfolio which is often a major market capitalization-weighted benchmark like the S&P 500 or MSCI ACWI. Comparisons with actively managed funds are imperfect because ATP does not have a beta-one benchmark, but nevertheless tracking errors relative to these benchmarks are informative about the relative level of risk taken by ATP in the Investment Portfolio. [Petajisto \(2013\)](#) reports that US all-equity mutual funds have an average tracking error of around 7 pct per year, with 3.5 pct for closet indexers, 6.0 pct for moderately active funds, 8.5 pct for stock pickers, 10 pct for “factor-bet” funds (funds taking both large factor bets and high tracking errors), and 16 pct for concentrated funds. Thus, even the highest-active-risk mutual fund category in Petajisto's taxonomy has tracking error only about half of ATP's Investment Portfolio volatility target. Even

viewed in terms of total volatility—the sum of benchmark risk and tracking error (or residual risk)—the most concentrated funds would have a volatility of $\sqrt{(0.15)^2 + (0.16)^2} = 22$ pct. Another comparison is to ask what tracking error would an active fund have if it reached a level of ATP's 30 pct total volatility on the Investment Portfolio? The required tracking error is $\sqrt{(0.3)^2 + (0.15)^2} = 26$ pct. In the universe of 1,200 active funds considered by [Ang, Madhavan, and Ribando \(2023\)](#), have an average residual return volatility of 5.0 pct per year, a median of 4.7 pct, and a range from 2.0 pct to 18.3 pct. ATP's 30 pct Investment Portfolio volatility target is roughly six times the residual active risk of the average active equity mutual fund and well above the maximum reported mutual fund residual volatility.

The high risk on the Investment Portfolio—and the leverage that implements it—are direct consequences of the required return reasoning described in Section 6.4. The indexation ambition requires high expected returns; high expected returns demand high risk on the Investment Portfolio; and obtaining that risk through a diversified, risk-balanced portfolio rather than concentrated equities demands further leverage. However, the required return is not the only justification for taking high risk—asset and liability modeling analysis is also used as a rationale, which we discuss in Section 7.4.

6.6 Implementing leverage

Key message

ATP uses leverage to convert limited risk-bearing capital into the investment exposures needed to meet its required return. The leverage arises from three sources. First, the Interest Rate Hedge Portfolio's use of interest rate swaps in place of some physical bonds, which delivers duration without consuming cash. Second, the need to scale the Risk-seeking portfolio's exposures above the cash capital sitting in the Bonus Potential. Third, the diversified factor portfolio's lower volatility per unit of notional exposure, which requires leverage to reach the risk target.

Leverage is implemented with derivatives, with collateral management, margin operations, and internal funding from the Treasury Portfolio keeping liquidity and balance sheet risks under control.

With approximately three-quarters of liquid market exposure held synthetically at end of 2025, gross leverage is approximately $2.4\times$ assets under management and net leverage is approximately $2.0\times$. Using the Investment Portfolio as the denominator net leverage is approximately $5.3\times$.

Leverage allows ATP to obtain desired investment exposure that exceeds what can be obtained from the cash capital available in the Risk-seeking Portfolios. The combination of mandatory nominal guarantees, additional ambitions to index tariffs with inflation, and a Bonus Potential that is small relative to the size of those guarantees leads to high required returns which cannot be obtained on a cash-only portfolio (see Section 6.4). In this section, we discuss how leverage is implemented at ATP: what leverage means, where it arises on the balance sheet, and the financial instruments used to obtain leverage.

6.6.1 Defining leverage

Leverage measures the extent to which a portfolio's market exposures exceed the capital that is directly invested in cash securities. In its simplest form, leverage means borrowing to buy additional assets. Like many large institutional investors, ATP obtains exposure through derivatives, swaps, futures, and externally managed vehicles as well as through cash securities. Useful definitions of leverage must therefore capture both balance-sheet borrowing and synthetic exposures created through derivatives.⁷⁹

*Leverage is not a single concept, and there are different uses and risks in obtaining leverage, necessitating several leverage measures—gross leverage, net leverage, and unencumbered cash.*⁸⁰

Gross leverage measures the total scale of exposures and sums the absolute value of positions. It is useful for operational and counterparty risk purposes because it shows the notional amount that must be traded, margined, and managed. This is the leverage measure typically reported in regulatory disclosures for derivative-using institutions (IOSCO, 2019). **Net leverage** adjusts for cash and offsetting positions and is closer to the balance sheet's economic exposure. Net leverage is not risk-weighted: one Danish krone of equity exposure and one krone of bond exposure count the same even though equity and bonds have different underlying risk. **Unencumbered cash** measures the liquid resources available to meet collateral calls, margin requirements, and other funding needs. This measure is especially important for ATP because much of its leverage is implemented through derivatives, where margin calls can be large during market crises. The distinctions between gross leverage, net leverage, and unencumbered cash matter because notional exposure is not the same as economic risk.

⁷⁹Section 4.4.1 discusses how institutional investors typically use three main channels—derivatives, repurchase agreements, and direct borrowing, each with different costs, collateral, and risk implications.

⁸⁰Ang, Gorovyy, and van Inwegen (2011), in their study of hedge fund leverage, distinguish between several leverage measures because different measures answer different economic and risk management questions. See also Adrian and Shin (2010).

6.6.2 Where ATP's leverage comes from

ATP's leverage arises from liability hedging, obtaining the desired risk level in the Risk-seeking Portfolios, and the decision to implement that risk through diversified rather than concentrated exposures. These sources are economically different and so it is not correct to say ATP has simply borrowed money to buy more risky assets. All three sources of leverage involve the full balance sheet of ATP; in fact, the liability hedging portfolio is the single largest balance sheet item. Leverage should thus naturally be assessed against the entire balance sheet, which is ATP's total funding base. Nevertheless, since investment losses, especially on exposure positions that are made possible with leverage, affect the Bonus Potential first, leverage can also be assessed relative to the risk-bearing capital that absorbs those losses. Both perspectives are necessary. A leverage measure that is compared to the Bonus Potential does not take into account the reserves on ATP's full balance sheet; a leverage measure that looks only at AuM may understate the loss potential on the Bonus Potential.

The first source and largest source of leverage is the Interest Rate Hedge Portfolio. ATP hedges the interest-rate risk of the Guaranteed Benefits with a combination of bonds and interest rate swaps. Compared with a hedge implemented only with physical bonds, swaps create the required duration exposure while leaving more cash and short-term bonds in the Treasury Portfolio. Thus, while it is economically correct to hedge the liabilities (Section 4.1), how those hedges are implemented matters. In the end of 2025 snapshot shown in Exhibit 6.19, swaps with a notional of DKK 289 billion sit alongside DKK 275 billion of hedging bonds, against Guaranteed Benefits of DKK 530 billion and a Bonus Potential of DKK 117 billion.⁸¹ The swap notionally appears on the balance sheet as gross exposure even though the underlying economic position is a duration-matched hedge of the liabilities; the same swap-for-bonds substitution that creates this gross exposure frees up the cash that would otherwise have been tied up in buying those bonds, and that freed cash is the internal funding source for the leverage on the Risk-seeking Portfolios.

⁸¹The exposure of the Interest Rate Hedge Portfolio swaps is negative because ATP receives fixed interest rates through the swaps to hedge the fixed nominal guaranteed benefits. This gains value when discount rates fall and liabilities rise and loses value when discount rates increase and liabilities fall. The negative bar reflects the liability-hedging direction of the position which reduces the economic exposure of the liabilities.

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Exhibit 6.19: ATP's application of leverage. The figure illustrates the decomposition of ATP's balance sheet, with liabilities on the left-hand side, and assets as the stacked waterfall on the right-hand side. For swaps in the Interest Rate Hedge Portfolio, the solid green bar is the market value of the swaps, where the transparent boxed area is the bond equivalent market value.

The second source is the need for exposure in the Risk-seeking Portfolios that exceeds the AuM of the Bonus Potential. The Investment Portfolio, the Supplementary Hedge Portfolio, and the Market Return Portfolio are designed to earn returns above the hedge asset. As discussed in Section 5.5, the Bonus Potential and related reserves are small relative to the Guaranteed Benefits they help support. The Risk-seeking Portfolios therefore require exposure that is large relative to their own capital if ATP is to pursue the return objectives of the product design. In the end of 2025 snapshot in Exhibit 6.19, derivative exposures of approximately DKK 487 billion and liquid cash assets of DKK 169 billion together back risk-taking against a Bonus Potential of DKK 117 billion. The multiple at which ATP runs varies with the funding ratio through the CPPI-like mechanism described in theory in Section 4.1.6 and in practice by ATP in Sections 6.4.3 and 7.5.3.

The third source is ATP's diversified, risk-balanced implementation of the Risk-seeking Portfolios. An all-equity portfolio can reach a given risk level with less notional exposure, but it concentrates risk in one dominant factor and has a greater probability of loss in any given year than an efficient portfolio that hold more lower-volatility exposures, including rates, inflation, credit, and other factors (see Sections 4.4.1 and 6.6.3). This can improve the reward-to-risk trade-off, but it also requires more notional exposure to reach the same target risk. In particu-

lar, Section 6.5 shows a target volatility of roughly 37 pct, which corresponds to ATP's required return, implies approximately 2.5× leverage on an all-equity portfolio but 3× to 4× leverage on a 60-40 portfolio. In this sense, part of ATP's leverage reflects the choice to take diversified risk rather than concentrated equity risk. Overall, the end of 2025 snapshot of ATP's balance sheet has the highest gross leverage of 2.4x and net leverage of 2.0× that ATP has run in the period from 2017 to 2025. Exhibit 6.19 reports a breakdown of leverage at the end of 2025. Unencumbered cash stands at approximately 13 pct of assets under management.

There is also indirect leverage in some private-market investments, principally in private equity and infrastructure, where the underlying portfolio companies and assets are themselves leveraged at the operating-company level or fund level (Kaplan and Strömberg, 2009). This leverage does not appear in ATP's gross or net leverage measures because the assets are held in fund or company-level vehicles, but it economically increases the underlying economic risk of those holdings. Indirect leverage of this kind, like the embedded leverage in any listed stock with debt, caps the investor's loss at the original investment—an equity holder cannot lose more than the equity stake, regardless of how levered the underlying entity is. Direct leverage taken at the ATP balance sheet level through derivatives is different: losses on a swap or futures position can mathematically exceed the cash initially posted as collateral, and in some cases can cause large enough losses to endanger the guaranteed liabilities (see also Section 7.4.) ATP does not use direct mortgage debt on its real-estate holdings, so this indirect leverage is concentrated in the private-equity and infrastructure portions of the DKK 117 billion illiquid pool shown in Exhibit 6.19.

6.6.3 How ATP implements leverage

ATP implements leverage mainly through derivatives and internal balance-sheet funding rather than through structural bank borrowing. This distinction is important. Borrowing money to buy assets creates refinancing risk and dependence on external lenders. Derivative implementation, by contrast, separates market exposure from cash funding: ATP can obtain exposure through swaps, futures, forwards, and related instruments while holding cash and short-term bonds in the Treasury Portfolio. As of end of 2025, 74 pct of ATP's liquid market exposure is held synthetically through derivative contracts rather than cash instruments. The trade-off is that derivative leverage creates collateral and liquidity needs, especially through variation margin when markets move sharply. This is managed by ATP's Treasury department (see Section 6.2).

In the Interest Rate Hedge Portfolio, ATP uses interest rate swaps together with bonds to hedge the interest-rate risk of the Guaranteed Benefits. A physical bond hedge would require ATP to hold a very large amount of long-duration bonds. Swaps provide similar duration exposure

with less cash tied up in physical securities, leaving cash and short-term bonds available in the Treasury Portfolio to provide stable, low-cost funding to the rest of ATP's balance sheet (see Section 6.2). This is the largest source of notional leverage on ATP's balance sheet, but it is also closely linked to the liability hedge rather than to a discretionary bet on risky assets.

In the Risk-seeking Portfolios, leverage is used to implement the desired exposure to liquid investment factors using equity, rate, inflation, credit, commodity, and currency swaps and forwards, and exchange-traded futures. These instruments are generally more cash-efficient than buying the corresponding cash securities, but they require initial margin, collateral, and daily liquidity management. Thus, the practical risk of this form of leverage is not only the size of notional exposure, but also ATP's ability to meet collateral calls under stress. Finally, all trades from various portfolios and strategies are netted internally before executing in the market, effectively lowering the gross exposure, making the overall portfolio mainly long-only.

The Treasury Portfolio is therefore part of the leverage implementation, holding the cash and short-term bonds that support margin, collateral, currency hedging, and other funding needs. Unencumbered cash is not residual idle cash; it is a risk-control resource that allows ATP to maintain derivative positions without forced sales during adverse market moves.

At the end of 2025 funding ratio of about 120 pct, shown in Exhibit 6.19, ATP's actual implementation has gross leverage of about $2.4 \times \text{AuM}$ and net leverage of about $2.0 \times \text{AuM}$. Around three quarters of liquid exposure is implemented through derivatives, and unencumbered cash is a large DKK 91 billion. These figures show that leverage is high, but they also show why leverage must be read together with liquidity resources and the type of exposure being taken.

ATP's end of 2025 balance sheet shows that economic exposure, which leverage enables, is spread across the full investment structure. Exhibit 6.19 is a waterfall chart of where the exposure on the balance sheet comes from, starting with the Interest Rate Hedge Portfolio (swaps and hedging bonds) to the Treasury Portfolio. The graph is complementary to the leverage decomposed by asset class in Exhibit 6.20. The bars build up to a total net leverage of approximately 200 pct of AuM. The Interest Rate Hedge Portfolio contains negative swap exposure and positive bond exposure. The Risk-seeking Portfolios then add exposure through illiquid assets, liquid cash assets, and derivatives. Consistent with the discussion above, the majority of the exposure above the assets under management is obtained through derivatives. Treasury assets further increase the gross balance sheet exposure. ATP's leverage is not applied to just a single purpose; ATP's leverage decisions reflect hedging, risk-taking, and investment implementation choices taken together.

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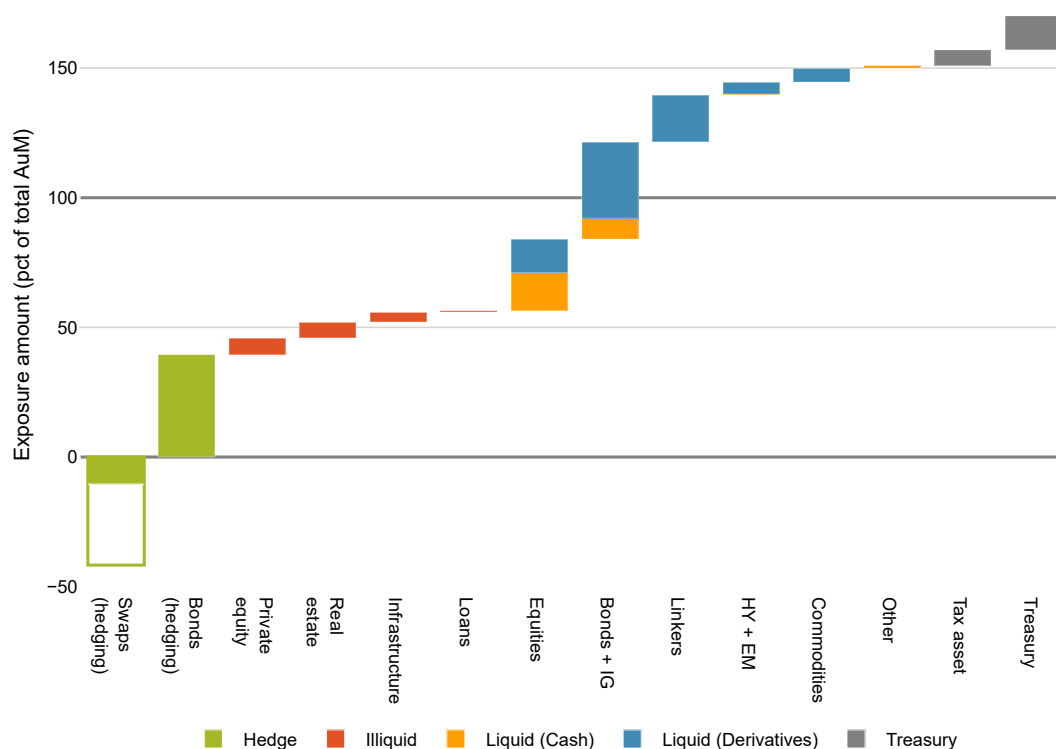


Exhibit 6.20: Asset allocation on total balance sheet on December 31, 2025. The figure illustrates the asset allocation as percentage of the total liabilities. The figure includes market value of the Interest Rate Hedge Portfolio, illiquid assets and the Treasury Portfolio. For the liquid assets, the exposure is split into two—cash investments are represented by their market value, whereas as derivatives exposures are translated into equivalent exposures, that is, 10-year nominal bonds (nominal interest rate swaps), 10-year inflation-linked bonds (inflation swap + nominal interest rate swaps), 5-year credit exposures (credit default swaps and nominal interest rate swaps). On the entire balance sheet, ATP is 2× levered, when using net leverage (that is, not double counting the notional in the swaps in the Interest Rate Hedge Portfolio).

At year-end of 2025, the leverage taken in the Investment Portfolio is approximately 5 times the Bonus Potential. Exhibit 6.21 reports the year-end 2025 composition of the Investment Portfolio after translating derivative positions into exposure-equivalent terms. The exhibit should not be read as a simple leverage ratio: it does not mean that ATP has borrowed five times the Bonus Potential. Rather, it shows the implementation required to deliver the Investment Portfolio's risk target. If the same risk target were implemented through a concentrated equity portfolio, the required exposure would be roughly 2×BP. ATP's diversified implementation requires approximately 5×BP because lower-volatility factor exposures (Section 6.3) require larger notional positions to contribute the same amount of portfolio risk. The exhibit therefore illustrates a core implementation trade-off: diversification reduces reliance on equity risk but increases the scale and complexity of the exposure-equivalent portfolio. The exhibit also illustrates how ATP's risk target is implemented in practice through a combination of cash investments, derivatives, and illiquid assets.

Review of ATP's Investment Strategy

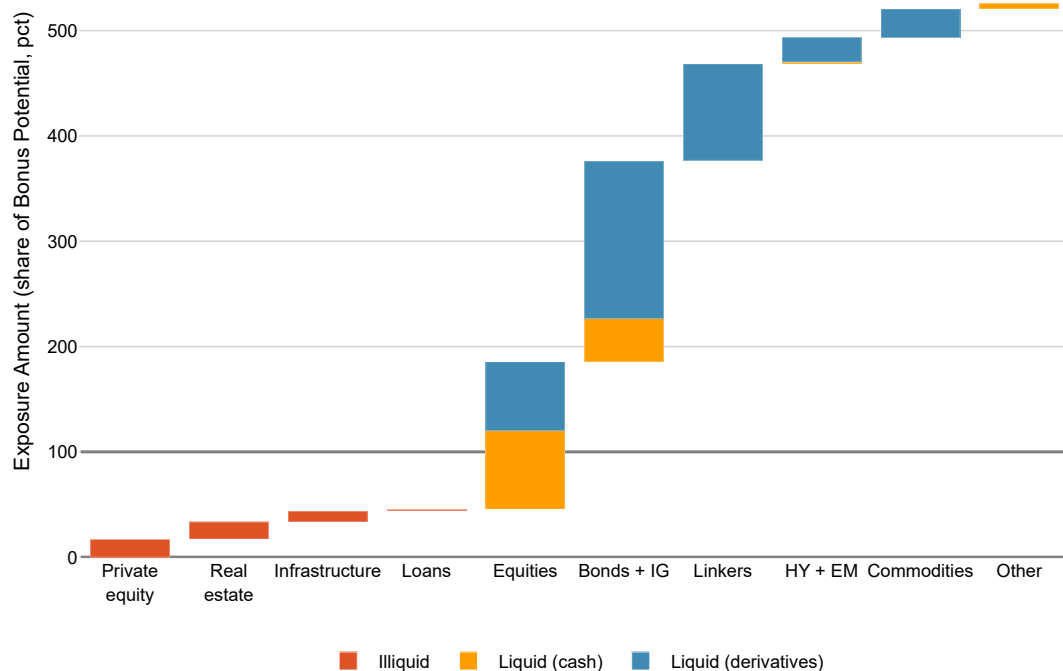


Exhibit 6.21: Allocation in the Investment Portfolio as of year-end 2025. The figure illustrates the asset allocation as percentage of the Bonus Potential. The figure includes the illiquid assets. For the liquid assets, cash investments are represented by their market value, whereas as derivatives exposures are translated into equivalent exposures of 10-year nominal bonds (nominal interest rate swaps), 10-year inflation-linked bonds (inflation swaps and nominal interest rate swaps), 5-year credit exposures (credit default swaps and nominal interest rate swap).

6.7 Investment implementation

Key message

ATP turns its factor framework (Section 6.3) and risk mandates (Section 6.5) into concrete portfolio positions through two design choices. First, the three Risk-seeking Portfolios—the Investment Portfolio (INV), the Market (M) Return Portfolio, and the Supplementary Hedge Portfolio (SAP)—invest through shared liquid and illiquid pooled funds rather than through separate portfolios; this gives each portfolio access to the same factor-balanced exposures while maintaining its own risk mandate at the balance-sheet level. Second, risk is allocated across factors through a hierarchical risk-budget process that runs from individual instruments to sub-factors to factors to the overall portfolio, with risk (not capital) as the unit of allocation.

6.7.1 Factor allocation

ATP allocates risk across factors with the objective of building a robust, diversified return-seeking portfolio. Section 6.3 shows that ATP harvests four factors: Equity, Rates, Inflation, and Other factors. These factors define the risks ATP expects to be rewarded for bearing. The factor allocation process determines how much of each risk should be held, where it should be implemented, and how closely actual exposures should track the long-term targets. Once the relevant factors have been identified, the portfolio construction problem is to determine how much risk should be assigned to each factor and sub-factor. This allocation is informed by historical evidence, capital-market assumptions, expected Sharpe ratios, correlations, implementation costs, complexity, leverage, liquidity, and concentration limits.

The ATP factor allocation process is hierarchical. Individual instruments are first combined into sub-factors, sub-factors are then combined into broader factors, and the factors are finally combined into the overall liquid portfolio, which is illustrated in Exhibit 6.22. Rather than using a traditional mean-variance optimization using capital (or dollars, see Section 4.4), ATP allocates a risk budget for different factors to each component before scaling the combined portfolio to the desired overall risk level.⁸² The risk estimates are computed with a risk model internal to ATP (see also Section 6.9.4 below). Given how ATP allocates risk, correlations—like the important the stock-bond correlation—do not matter for the relative weight between allocations to factors, but they matter for determining the overall risk level and the required portfolio leverage.

⁸²The construction is similar to the hierarchical risk parity portfolio construction technique of López de Prado (2016) except it takes into account expected returns, which López de Prado does not.

Review of ATP's Investment Strategy

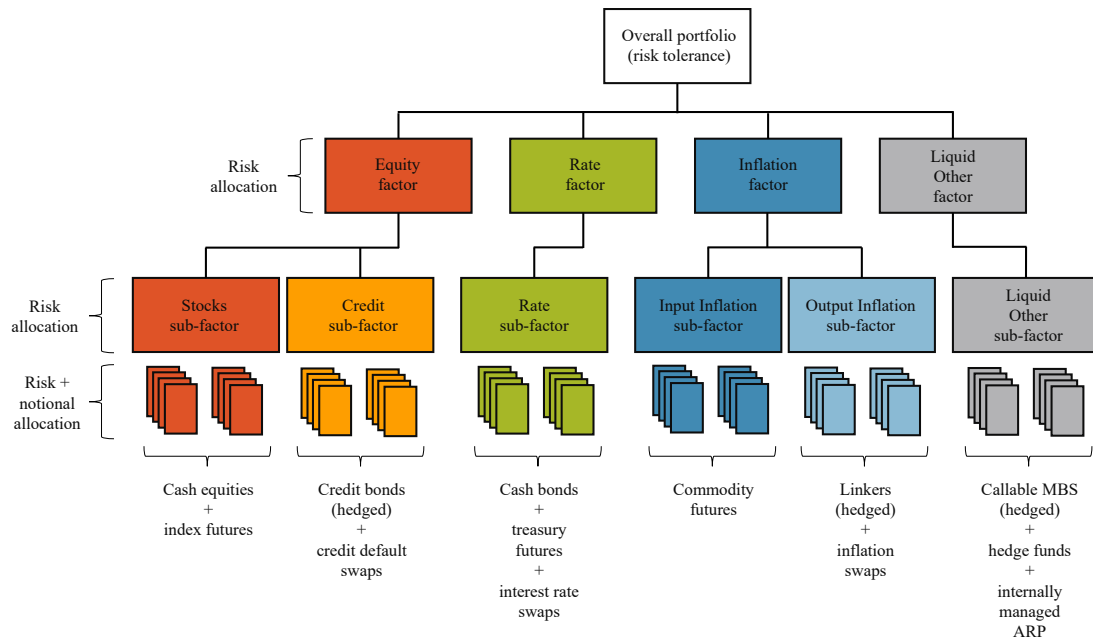


Exhibit 6.22: ATP's hierarchical portfolio structure from individual assets to the overall liquid portfolio. At each level, decisions must be made, either on single asset selection, allocation to a particular sub-factor or factor, or at the very top, choosing an appropriate risk level. The figure also illustrates which asset classes are present in particular sub-factors, and also which metrics are used for the particular allocation at a particular place in the portfolio structure.

ATP's factor allocation approach allows it to attain a risk-return combination that is very close to the theoretical capital allocation line (see Section 4.4.1). Exhibit 6.23 illustrates this with an unconstrained efficient frontier, when all liquid assets in ATP's universe are included. The exhibit plots the corresponding capital allocation line together with ATP's current factor allocation. There are two alternative allocations: the global market portfolio and the liquid portfolio of a Danish institutional portfolio. ATP is not exactly on the capital allocation line as its factor and subfactor weights are not fully optimal under ATP's capital market assumptions. However, the deviations are similar in size to the deviations of the two alternative portfolios away from the efficient frontier.

Review of ATP's Investment Strategy

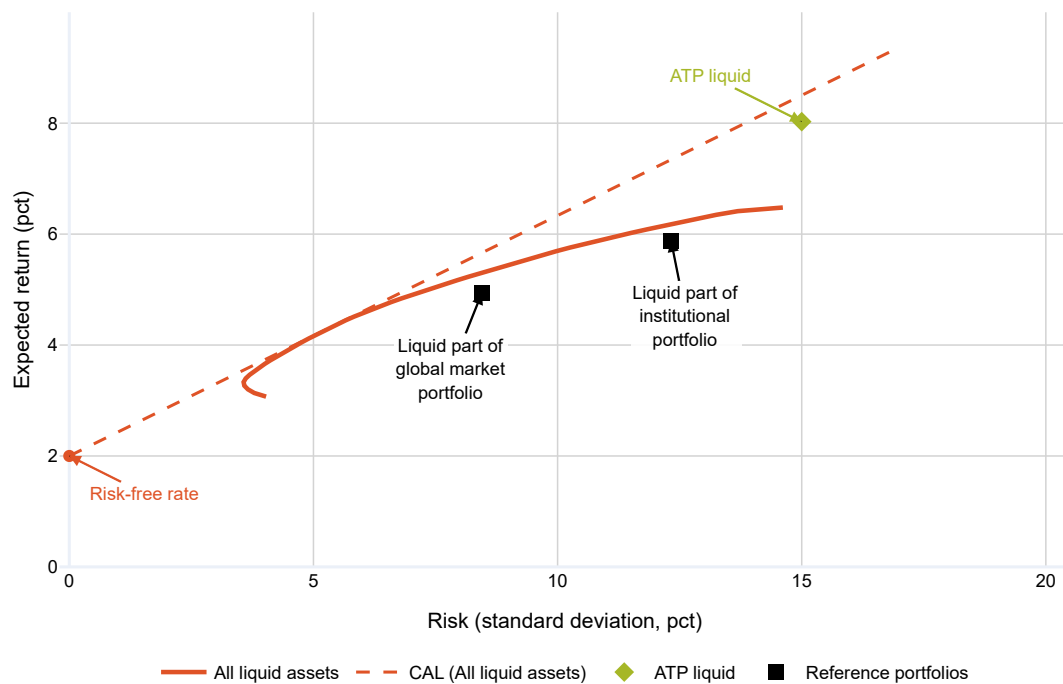


Exhibit 6.23: Efficient frontier and capital allocation line for an unconstrained liquid investor. The exhibit plots the unconstrained efficient frontier when all liquid assets in the analysis model are included with the corresponding Capital Allocation Line (CAL). ATP's current factor allocation and two alternative allocations are shown. The two alternative allocations are the liquid assets in the global market portfolio, following the 2024 update of [Doeswijk, Lam, and Swinkels \(2014\)](#) and [Doeswijk, Lam, and Swinkels \(2020\)](#), and a proxy for the liquid part of a Danish institutional portfolio, based on the average allocation in a medium risk market-rate product with 20 years to retirement (see Section 4.6.2).

ATP's liquid allocation to factors, however, is close to the theoretically optimal portfolio once implementation complexity is taken into account. To assess the allocation, ATP compares five portfolios: an unconstrained optimized portfolio, an optimized portfolio with a penalty for complexity, ATP's current liquid allocation, the liquid part of the global market portfolio, and a proxy for the liquid part of a Danish institutional portfolio. (Appendix E details the optimizations and comparisons.) The unconstrained optimization produces a large allocation to alternative risk premiums, reflecting their assumed Sharpe ratios and diversification benefits, but also illustrating the sensitivity of the result to complex strategies that are harder to implement and monitor. Once a complexity penalty is introduced, the allocation to alternative risk premiums falls materially and the optimal portfolio becomes much closer to ATP's actual liquid factor allocation. Compared to a typical institutional portfolio, ATP's allocation has a higher allocation to interest rates, inflation and alternative risk premium strategies, but a lower allocation to equities.

Robustness

ATP tests the robustness of its factor allocation in different scenarios. The robustness tests include different sets of capital-market assumptions, including scenarios with higher and lower

rate-factor Sharpe ratios, higher volatilities, and less favorable stock-bond correlations, and compare ATP's allocation with optimized portfolios, the liquid part of the global market portfolio, and a representative Danish institutional portfolio. The detailed assumptions, tables, tracking-error estimates, and outperformance probabilities are reported in Appendix E. The main finding is that ATP's current allocation gives up little in expected risk-adjusted return relative to the optimized portfolios, while remaining more diversified than conventional portfolios. The attractiveness of ATP's approach depends on horizon: over one year, relative performance can easily be dominated by short-term variation, but over longer horizons the probability of outperforming more traditional portfolios increases (see also Section 6.3.4). The current portfolio weights are deliberately chosen to balance the baseline case against less favorable rate scenarios, including a lower expected return to the rates factor and a higher equity-bond correlation. This weighting reflects ATP's view that regime-change risks, such as term-premium repricing or geopolitical shocks, may not be fully captured in standard capital-market assumptions.

Factor allocations in illiquid markets

ATP also takes a factor investing framework to its illiquid portfolio using factor targets, concentration limits, and public market equivalent risk measures. Every year, the Supervisory Board sets an illiquid risk target based on the requirements for the Risk-seeking Portfolios. In addition, the Supervisory Board sets factor risk targets, factor risk limits and maximal market values in each asset class. The risk measurement is computed with public market equivalents (Section 4.3.4), based on a look-through estimate of the portfolio's underlying economic exposures, rather than on accounting values that may smooth reported returns.

The hierarchical structure (see Exhibit 6.24) runs from the four main factors (Equity, Rates, Inflation, Other) to subfactors, to asset class, and then to individual investment. The most important decision is at the top—ATP sets a factor target rather than deciding on a particular allocation to an illiquid asset class. Illiquid asset classes such as private equity, real estate, infrastructure, and private credit are implementation vehicles to express those exposures. For example, the same asset class can have very different risk characteristics depending on whether the investment is core, core-plus, value-added, or opportunistic. Illiquid investments must meet traditional bottom-up requirements (that is, WACC) but also factor-based return requirements. A new illiquid investment should earn at least as much as comparable public market equivalent risks and should also improve the overall portfolio. An investment may therefore be rejected even if it is attractive on a stand-alone basis, if it adds exposure to factors or asset classes where the portfolio is already overweight.

Review of ATP's Investment Strategy

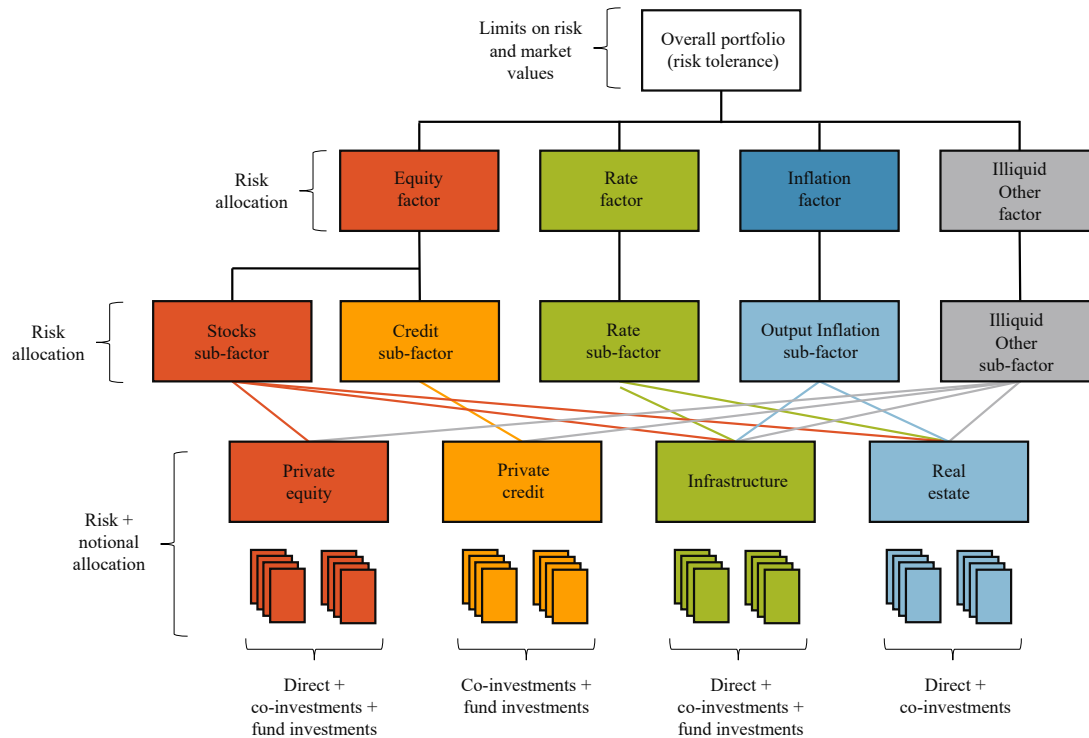


Exhibit 6.24: Illustration of ATP's hierarchical portfolio structure from individual assets to the overall illiquid portfolio. The figure illustrates the hierarchical portfolio structure of ATP's illiquid portfolio. At each level decisions must be made, either on single asset selection, allocation to a particular sub-factor or factor, or at the very top, choosing an appropriate risk level. The figure also illustrates which asset classes and implementations are present in particular sub-factors, and shows which metrics are used at a particular place in the portfolio structure.

ATP also employs concentration limits on its illiquid investments because in some cases, the factor model can produce overly concentrated illiquid portfolios. One example is that the pure factor model would result in an illiquid portfolio that holds almost all real estate, because real estate provides an attractive combination of Equity, Rates, Inflation, and illiquidity exposures under the model assumptions. Even if the factor exposures appear diversified, the portfolio may still be concentrated in one asset class and exposed to common liquidity, governance, implementation, and other risks. Adding a concentration penalty pushes the portfolio away from a near-real-estate solution and toward a broader mix of private equity, real estate, infrastructure, and private credit. Adding a leverage penalty further changes the allocation, because higher-volatility asset classes such as private equity can achieve the same risk target with less leverage. (Appendix E contains further details.)

6.7.2 Implementation with pooled funds

ATP invests its risky assets through two funds: A liquid fund and an illiquid fund rather than through separate asset portfolios for each of the portfolios on its balance sheet. The Risk-seeking Portfolios own shares in the pooled funds and receive returns based on their ownership shares. (Until the introduction of the new elements to ATP's business model, discussed

Review of ATP's Investment Strategy

in Section 5.5.6, all liquid and illiquid investments were owned by the Investment Portfolio.) Exhibit 6.25 illustrates the relationship between liabilities, portfolios and the pooled funds. The Investment Portfolio holds a greater weight in the liquid pooled fund reflecting its need to re-balance, occasionally de-risk, and to pay bonuses. The Supplementary Hedge Portfolio and the Market Return Portfolio are more long-term and have less need for short-term rebalancing and liquidity and, consequently, hold larger allocations of the illiquid pooled fund.

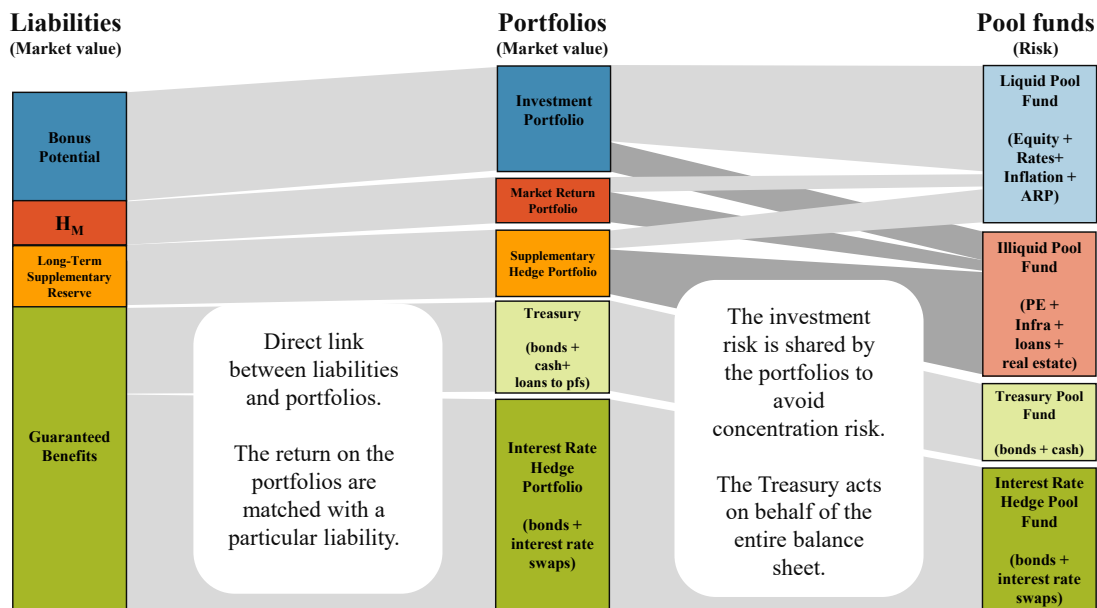


Exhibit 6.25: Link between liabilities, portfolios, and pooled funds.

*The pooled fund structure separates the economic design of the Risk-seeking Portfolios from the operational implementation of the underlying assets: ATP can decide how much liquid and illiquid risk each portfolio should bear, while managing the underlying investments centrally.*⁸³ Once an asset can be held by multiple Risk-seeking Portfolios, booking it once into a pooled fund rather than splitting the trade across portfolios reduces operational complexity. It also allows each Risk-seeking Portfolio to hold a more diversified slice of the underlying assets—especially for illiquid assets—than it would under direct ownership.

The ownership of the pooled funds has shifted as ATP's new business model has been implemented. Exhibit 6.26 reports the owner shares of liquid and illiquid pooled funds. Before the new business model, the Investment Portfolio held all risky assets and was the sole owner of both pools. The Life Annuity with Market Exposure was introduced in 2022 and the Market Return Portfolio now holds a small share of the liquid and illiquid pooled funds. The most significant change has been the introduction of the Supplementary Hedge Portfolio in 2023, which

⁸³ATP's pooled fund setup also has separate 100 pct individually owned pooled funds for each portfolio. For example, the Investment Portfolio has its own pool fund which can for instance be used to trade and book put options bought to protect the Bonus Potential.

moved to full implementation by the end of 2025. As of end of 2025, the Supplementary Hedge Portfolio owns 13 pct of the liquid pool and 53 pct of the illiquid pool. The Investment Portfolio owns 85 pct of the liquid pool and 45 pct of the illiquid pool. The Market Return Portfolio is still small and owns slightly below 2 pct of both the liquid and illiquid pool.

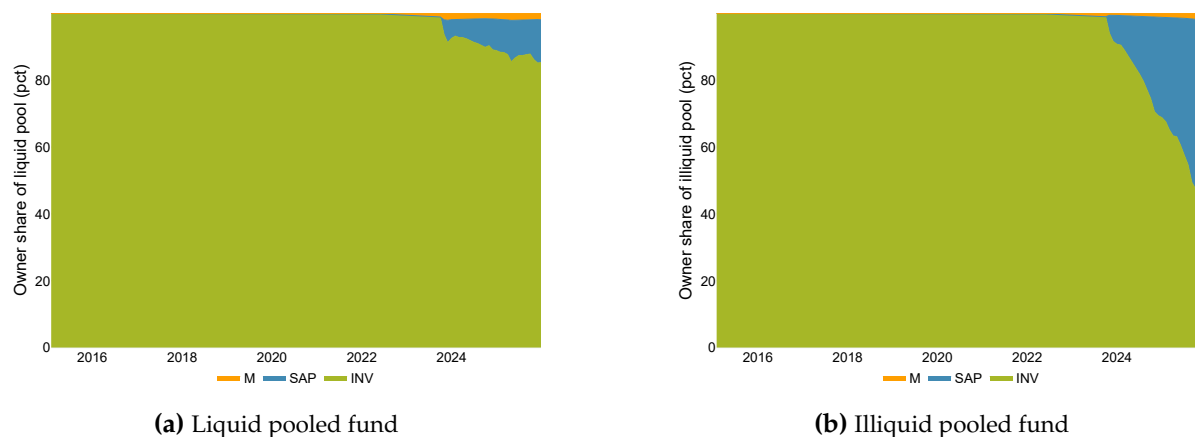


Exhibit 6.26: Owner shares of liquid and illiquid pools. The figure illustrates which portfolio (that is, the Investment Portfolio (INV), the Supplementary Hedge Portfolio (SAP) or the Market Return Portfolio (M)) owns the assets in the liquid and illiquid pools. Note, the Market Return Portfolio was implemented in 2022 and the Supplementary Hedge Portfolio was implemented in 2023.

Consistent with ATP's factor investing framework, the owner shares are not determined by market values but by each portfolio's risk target. Any funding required to purchase the relevant pool shares by each of the Risk-seeking Portfolios is funded by the Treasury Portfolio. The allocation is implemented in two steps. First, illiquid risk targets are set, and owner shares of the illiquid portfolio are allocated pro-rata to the risk targets. Second, liquid risk targets are calculated, accounting for each portfolio's actual illiquid risk, and owner shares of the liquid pool are again allocated pro-rata to the liquid pooled fund so that any overall risk surplus or deficit is traded over the following days to meet their risk targets. As such the entire liquid pool serves as a completion portfolio.

6.8 Illiquid assets

Key message

ATP's illiquid investments framework spans deal sourcing, due diligence, and ongoing asset management. ATP accesses illiquid assets through internal units, strategic partnerships, managed funds, and selective direct investments.

ATP's experience with direct investments has been mixed. Managing direct ownerships and creating value as an investor proved harder than expected. Investments were also

Key message (continued)

too concentrated—in a few vintages and in individual positions that were too large—leaving ATP exposed to single-company risk that runs against its core belief in diversification.

These lessons inform clear strategic focus points: favoring partnerships over direct ownership, sizing investments appropriately, investing continuously to avoid vintage concentration, and ensuring realistic exit plans. Legacy positions will take several years to unwind, so the new direction will take time to dominate—but ATP has already made progress in gradually downscaling the illiquid portfolio in line with its strategy.

ATP's illiquid assets are central to its investment strategy, and as part of our review we asked ATP to briefly describe its illiquid investments framework, to reflect on the lessons learned in illiquid investments, and to outline the strategic focus moving forward. Since the description, reflections, and outline are directly from ATP, they are presented with a green line in the margin. We evaluate ATP's management of illiquid assets in Section [7.7.3](#).

6.8.1 Illiquid investments framework

By “illiquid investments framework” we refer to the set-up surrounding the various steps necessary to make an investment decision, implement it, and manage the asset subsequently. This includes 1) having access to investment opportunities and being able to source deals, 2) performing due diligence, and 3) having an asset management process. Below, we describe those three parts.

Access to investment opportunities and sourcing of deals

ATP maintains ongoing long-term relationships and engages in dialogues and knowledge sharing. There are long-term relationships with investment banks, asset managers, and General Partners, which enable screening of potential investment opportunities. There are also dialogues and knowledge sharing amongst institutional peers in Denmark and abroad including on-site visits to experienced institutional investors to gain best-practice insights in investing and managing illiquid assets.

Illiquid investments are accessed through several routes:

- *Internal units and subsidiaries*, which provide access to experts and competences in a focused and efficient format (ATP Private Equity Partners and ATP Real Estate).
- *Strategic partnerships*, where ATP's size and attractiveness as an institutional client

can be utilized to obtain significant fee and carry reductions while harvesting the benefits of selected partners' scale advantages, market access, relationships, and track record across a broad set of illiquid assets.

- ***Direct investments or co-investments.*** ATP maintains the capacity to conduct direct investments by monitoring and working alongside experienced specialist managers. This is not the primary approach, and under normal circumstances ATP will not be a majority investor.
- ***Managed fund structures,*** which act as fiduciaries on ATP's behalf. This approach is favored for its operational efficiency and ability to build internal competencies.
- ***Syndicated approaches with major banks.*** ATP occasionally participates in risk sharing transactions with major banks, often at favorable fee levels at the cost of operational complexity.

Due diligence

When considering illiquid investments the due diligence process is tailored to the risks and complexities of the investment opportunity. The process aims to ensure a robust risk-adjusted return, and that ATP fully understands and can manage the risks involved. The investment process involves up to four gates, where the relevant stakeholders are consulted and given time and support to carry out independent and critical analysis of the investment proposal. The investment process is further described in Section [6.9.3](#).

Due diligence involves:

- ***Initial screening:*** Assessment of investment relevance to ATP's portfolio, often in dialogue with CIO and investment strategy teams.
- ***Risk analysis:*** Detailed review of historical financials, forecasts, budget assumptions, cash flow, capital needs, and liquidity.
- ***Technical due diligence:*** For physical or operational assets, this entails evaluation of asset conditions, technological maturity and operational risks, often involving external specialists.
- ***Operational due diligence:*** Examination of organizational structure, governance, processes, systems, and business partner relationships.
- ***Legal due diligence:*** Review of all legal, contractual, and regulatory aspects to confirm

the structure and rights associated with the investment.

Depending on the size and nature of a transaction, the CEO and/or Supervisory Board will be involved in the final approval and sign-off.

Asset management

Asset management involves all ongoing operational processes once the investment is made.

This includes risk management, valuation, asset management review, and control of illiquid investments.

- **Risk management** has the ongoing responsibility to measure risk, monitor compliance with investment limits, and to follow-up on exposure across all illiquid investments. This includes quantitative risk modeling, qualitative assessment, and fit with strategy purpose.
- **Valuations** of illiquid assets are conducted on an ongoing basis. These serve as continual checkpoints for both performance and associated risks, with periodic reassessment in the event of significant market developments or new asset-specific information.
- **Asset management reviews** are performed regularly and during reboarding/offboarding of investments. Risk model assumptions and parameterizations for each type of illiquid asset are reviewed, ensuring they remain a fair reflection of actual market risk and performance characteristics. Updates are triggered by new material developments as well as scheduled reviews that take place quarterly with one major review at least annually. Changes in the capital structure and new funding rounds are treated as a new investment decision.
- **Governance and controls** regarding investment approval, valuation, and risk are ensured by Middle office, which also ensures that all illiquid investments are routinely monitored and that results are documented and available for internal and external reviews. It also checks that all activities remain within approved limits and risk appetite. Illiquid asset risk and valuation modelling are under direct oversight of the Supervisory Board and the dedicated steering group.
- **Reporting and performance assessments** are carried out regularly under a strict governance setup and are driven independently from the Investment department by teams residing under the CRO. They include risk-adjusted returns based on ex-ante factor mapping into ATP's liquid factors. They also include PME and non-risk-adjusted measures such as TVPI and IRR as well as qualitative updates when deemed appro-

appropriate. Prepared internal reports also often focus on portfolio composition, risk profile, and adherence to overall strategy for illiquid assets.

- **Supportive IT-infrastructure.** ATP uses an internal software system developed to support and document the organization's investment processes as an integral part of the illiquid investments framework. It serves as a central platform where all relevant materials, decisions, and reporting related to ATP's investment and asset management activities are stored, managed, and easily accessed by employees.

The above-mentioned illiquid investments framework has been developed and refined over the last six years. It is viewed as part and parcel of being a professional and prudent institutional investor although ATP finds this a necessary but not sufficient condition for securing strong performance in its illiquid investments.

6.8.2 Lessons learned in illiquid investments

Overall, ATP's experience illustrates that there are significant risks associated with individual investments irrespective of the underlying risk drivers in the specific companies. These idiosyncratic risks can be rather exogenous, and hence difficult to control, or endogenous, which require a large amount of resources to manage. ATP has obtained valuable experience from its exposures to large and concentrated illiquid investments, and based on those, ATP has chosen a stricter regime regarding new single direct investments and developed a set of focus points framing which type of investments can be made.

Some of the lessons from ATP's experience in this field are summarized below, and in the next subsection the focus points are explained.

Direct ownership is difficult. Direct ownership of companies is difficult and requires broad competencies within strategy and management of companies and very specific competencies within specific sectors or special disciplines.

In order not to spread ATP's competencies across too many single investments, it is appropriate to limit the number of investments to enhance focus and utilize resources better and possibly engage with a more resourceful majority partner.

Institutional investors like ATP should focus on attracting the right competencies that fit the business model rather than try to emulate private market funds. Private equity funds have the scale to extensively build organizations that have specialized competencies across the relevant asset spectrum and over the full value chain when investing directly across a large set of companies. This is generally more difficult for institutional investors like ATP,

whose remuneration model, cost focus, and varied job tasks lean more towards attracting a limited number of employees with strong generalist types of competencies. Furthermore, ATP is not allowed to be a majority investor, which has implications for the operating model and required skillsets for employees. When done successfully, this ensures a lean, effective organization with a more personal engagement across the full value chain on investments. Acknowledging this important characteristic is crucial, and it has the implication that ATP's capacity to successfully do direct investments is bounded and that other avenues, such as teaming up with external partners, should be prioritized. Since remuneration is largely not directly linked to the performance on individual investments, it is beneficial for ATP that employees are involved as much as possible in the entire life cycle of the investment in order to bear its consequences. It is therefore important that one remains explicitly cognizant of implicit incentives for investment managers to focus more on getting the investment done rather than managing the investment in the long run.

The choice of co-shareholders and governance structures is crucial. Experience from some of ATP's direct investments indicates that it is crucial to have similar values and financial interests with the co-shareholders in each investment. The converging interests must also cover the rules and approach to the management of the ownership of the company in question. There is a risk that the shareholders internally disagree on too many aspects of the company's operation and development, just as the number of shareholders alone can contribute to heavy decision-making processes and a lack of agility.

Avoid concentration risk on size and vintage. The many direct acquisitions in the years 2017–2019 resulted in an overly concentrated vintage risk, where most investments shared the same investment conditions and valuations. History will determine the realized quality of a particular vintage and the experience of ATP PEP's many funds spread over several years since 2003 shows that vintage has a major impact on the realized performance. With too highly concentrated investments, idiosyncratic performance has a disproportionate impact on ATP's total return. This is undesired, often unrewarded, difficult to explain, and inconsistent with ATP's investment beliefs regarding diversification.

Themed investments are not always successful. Investors are regularly hit by special themes and so-called mega-trends, which many investors pursue. This often implies expensive pricing created by low required returns by investors, high expectations of future growth, and poor return-risk ratios. Such trends can be created by political trends or major societal challenges (such as the green transition), technological developments (such as AI), or something different. Without going into details, ATP has also been affected by such trends, and historically ATP's theme-based cornerstone investments have often delivered poor returns and

high costs. Experience shows that prudent investors should exert the utmost caution not to just “go with the flow” when such trends are at their peak.

6.8.3 Strategic focus points

This section defines the major strategic focus points for ATP's approach to illiquid investments. The focus is on the illiquid investments made by the team, Global Direct Investments, and, to a lesser extent, teams Long-term Danish Capital and Danish Equities. Hence, the strategic focus points do not directly concern ATP Real Estate and ATP Private Equity Partners, which by design are less exposed to the above-identified issues and have separate strategies for their asset classes.

The total amount of illiquid assets that ATP seeks to hold is determined in the investment strategy, and the focus points here do not address this issue. Similarly, the focus points do not address the types of illiquid assets that ATP should target.

Size of investments—“not too big, not too small.” ATP should aim for an appropriate investment size that balances different concerns. For example, the desire to obtain appropriate minority shareholding and governance rights while keeping costs down should be balanced against the need to avoid too much exposure to a single company. At the same time, there must be room for the investment to grow both in the form of additional capital injections and in the form of the company developing positively. Therefore, a certain size range for investments has been decided upon. Smaller or larger investments can be made, but this carries a “burden of proof.” Fund investments can be larger, as these will typically be spread over several investments.

Partnerships rather than direct investments—direct ownership requires a special case. As a main approach, ATP should seek to enter partnerships with funds or other similar investors who have the scale, resources, and competencies to “lead” on a given investment. This can be in the form of partnerships that contain several investments, or partnerships that only concern a single investment. Partnerships will typically be more expensive than direct ownership, but conversely, by choosing the right partnerships, ATP can gain privileged access to deep competencies and greater breadth of resources.

Direct ownership of companies will only be used in special cases where it provides a special advantage, or where ATP can contribute special competencies that are of significant benefit to the company in question.

Direct ownership will most likely be in Denmark, where ATP's local knowledge, brand, and

reputation have been significant strengths. The investments will be minority holdings with a focus on achieving appropriate influence on the board of directors. In addition to this, it may be appropriate for ATP to use external competencies on boards of directors and in value creation to ensure experience and sufficient specialist knowledge or to ensure a sufficient arm's length between ATP and the company (balanced with supervisory requirements for insight).

Invest continuously and avoid vintage concentration. ATP will aim to make a few investments annually to ensure a balanced development in the portfolio, where assets are continuously bought and sold. This is to avoid vintage concentration. This will also contribute towards a more stable usage of the liquidity pool. Thus, a stable portfolio must be created with ongoing purchases and sales, one in which the daily management can also set up an efficient organization whose structure, scope, resources, and competencies can be arranged according to size and “modus vivendi.” It can also support the daily management in being selective and only investing in opportunities that meet all the set requirements.

Choose co-investors and partners carefully and avoid complex governance structures. In the selection of investments, emphasis must be placed on limiting the number of co-shareholders in the individual investments and ensuring that all shareholders share a basic view of the investment and the governance setup surrounding it. For example, it can entail securing agreement on the risk profile of the development, operation of the asset, and any exit plans. Efforts must also be made to avoid complex governance structures.

Don't forget the exit plan—there should be a realistic way out. It is of key importance that there are realistic exit plans and/or dividend policies in each individual investment, so that ATP has flexibility in relation to the length of ownership and the size of the investment. This focus also contributes to an investment culture focusing on the whole life cycle of investments.

6.9 Investment governance and risk management

Key message

ATP's investment governance framework assigns strategic risk choices to the Supervisory Board and implementation choices to the daily management. The Supervisory Board sets the risk appetite, portfolio risk targets, factor targets, and limits within which the investment organization operates; the daily management then implements those decisions through the liquid and illiquid pools, investment processes, and daily risk controls.

6.9.1 Roles of the Supervisory Board and daily management

The Supervisory Board sets the overall risk tolerance, the portfolio risk targets for the Risk-seeking Portfolios, and the limits around those targets. Section 6.5 describes the risk limits for the Investment Portfolio, Market Return Portfolio, and the Supplementary Hedge Portfolio, and indicates that they are high, reflecting the risk needed to deliver the ambitious inflation indexation objectives.

The Supervisory Board also sets factor-level targets and limits, while the daily management decides how those exposures are implemented. This includes the allocation across subfactors, geographies, instruments, and strategies, with the Supervisory Board setting limits on factor exposures, asset classes, geography, concentration, and overall risk. The factors themselves are thus endogenous rather than explicitly given: that is, the Equity factor comprises stocks and corporate bonds which ATP's daily management decides to have exposure to, rather than being a predefined reference from the Supervisory Board. This approach makes ATP closer to the total portfolio approach (TPA) model of asset management (see Section 4.5.5) than the endowment model, which fully specifies asset class holdings. The daily management is free to express those factor exposures in different asset classes, as described in Section 6.3. However, ATP is unlike TPA in that the Supervisory Board does not set a single reference portfolio (an equity-bond benchmark portfolio), but sets the permissible risk space within which the daily management builds the best overall portfolio.

ATP's daily management uses an internal implementation portfolio to translate the Supervisory Board's risk and factor targets into tradeable exposures. This process converts the approved risk allocation into notional exposures, durations, and other portfolio metrics that portfolio managers can implement in markets. The implementation portfolio is not a Supervisory Board benchmark or strategic asset allocation; it is an operational tool for making the risk mandate tradeable.

6.9.2 Pool governance

ATP governs the liquid and illiquid pools separately because they play different implementation roles. The liquid pool is the completion and rebalancing portfolio: its size and composition adjust to meet total risk and factor targets after taking account of the slower-moving illiquid pool.

Liquid Pooled funds

The Supervisory Board sets the long-term factor allocation and limits for the liquid pool, while the CIO can implement overweights and underweights within those limits as economic condi-

tions and implementation constraints change. Exhibit 6.27 illustrates the hierarchy of the factor decisions—repeated from Exhibit 6.22 but with the addition of which decisions are made by the Supervisory Board or daily management. For example, the decision to allocate to subfactors and the decision on which geographies to allocate to (such as North American or European stocks, for example) reside with ATP's daily management.

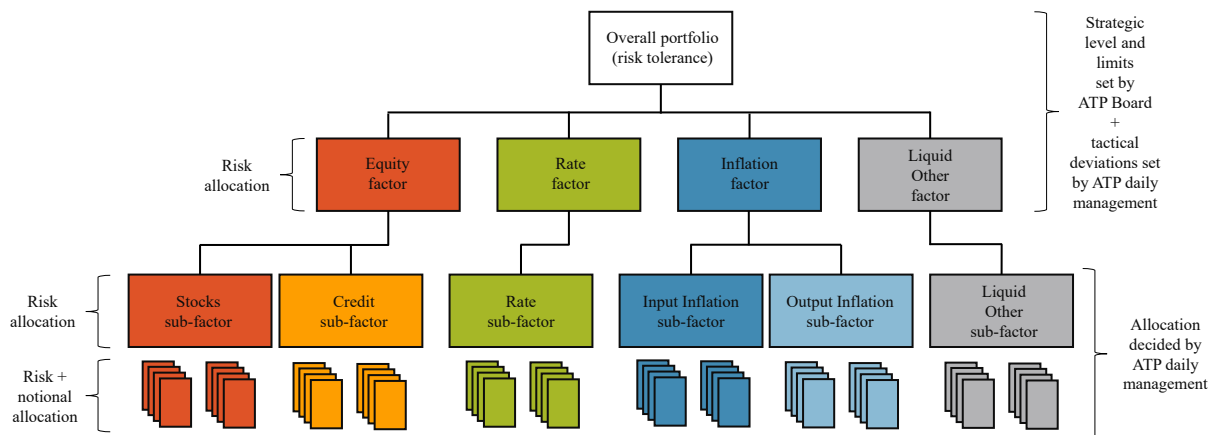


Exhibit 6.27: ATP's hierarchical portfolio structure in the liquid pooled fund and delegation of investment decisions. The figure illustrates the hierarchical portfolio structure which enters ATP's liquid portfolio. At each level, decisions must be made, either on single asset selection, allocation to a particular sub-factor or factor, or at the very top, choosing an appropriate risk level. The figure highlights which decisions are made by ATP's Supervisory Board, and which reside with ATP's daily management.

Illiquid Pooled funds

The illiquid pool is governed through factor targets, concentration limits, market-value limits, and single-investment controls rather than a fixed asset-class benchmark. The Supervisory Board sets the desired factor risk profile and the main diversification constraints, while the daily management selects individual investments in Private equity, Real estate, Infrastructure, Private credit, and other illiquid strategies. Exact factor matching is not possible in illiquid markets because investments are lumpy and cannot be rebalanced continuously; the targets therefore guide the types of risks ATP wants to own and the degree of concentration it is willing to accept.

Review of ATP's Investment Strategy

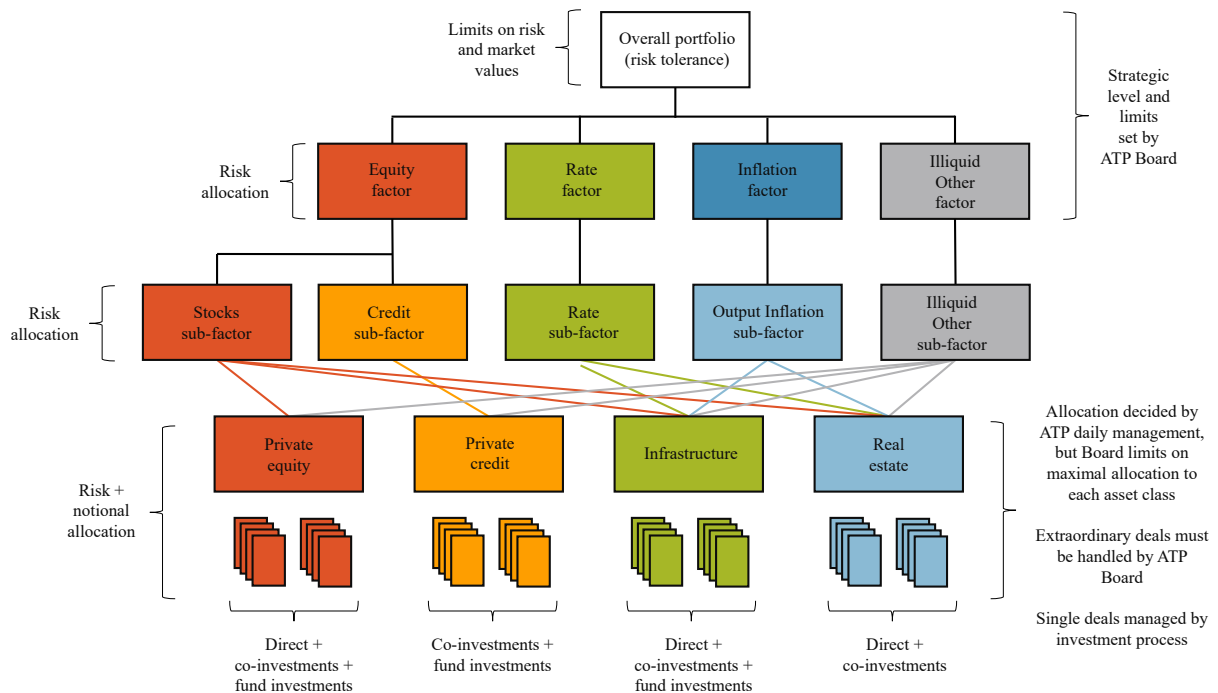


Exhibit 6.28: ATP's hierarchical portfolio structure in the illiquid pooled fund and delegation of investment decisions. The figure illustrates the hierarchical portfolio structure which enters the illiquid portfolio. At each level, decisions must be made, either on single asset selection, allocation to a particular subfactor or factor, or at the very top, choosing an appropriate risk level. The figure highlights which decisions are made by the Supervisory Board or daily management.

ATP's Supervisory Board also sets concentration limits on how much market value can be allocated to four major illiquid asset classes: Private equity, Private credit, Infrastructure, and Real estate. Currently Private equity has a maximum of 40 pct of the portfolio, where the remaining asset classes can be maximally 35 pct of the portfolio. Additionally, the Supervisory Board sets limits on how large single investments can be, where exceptions need to be approved by the Supervisory Board, such as Copenhagen Airport. Exhibit 6.28 illustrates the hierarchy of decisions in the illiquid pooled funds—repeated in Exhibit 6.24, but with the addition of which decisions are made by the Supervisory Board or daily management. The Supervisory Board provides guidance on the types of risk which are wanted, and the daily management is allowed to choose the asset which fits the portfolio the best—no matter if it is private equity or value-added infrastructure. The additional risk and market value based Supervisory Board limits on the illiquid pooled funds help limit concentration risk in the illiquid portfolio.

Investments in the illiquid pooled funds are handled on a case-by-case basis. Investments come in the form of direct investments, co-investments or fund investments. Fund investments delegate underlying portfolio selection to the external manager within the approved fund mandate. Direct investments and sales are handled through ATP's investment process, while ATP Real Estate and ATP Private Equity Partners provide dedicated subsidiary structures for parts of the real estate and private-equity implementation, respectively, with ATP senior staff sitting

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on the supervisory boards for the two subsidiaries. For ATP Real Estate, every investment over a given threshold is approved in the same investment process as for any other investment. For ATP Private Equity Partners, every fund is treated as a new investment. The investment in a new ATP Private Equity Partners fund is treated as an extraordinary investment and needs to be approved by ATP's Supervisory Board.

6.9.3 Investment processes

ATP's investment process is designed so that each material investment is sound on a stand-alone basis and consistent with the total portfolio. The process applies to onboarding new investments and strategies, reboarding material changes or follow-on investments, and offboarding existing investments or strategies. It reflects the prudent-person principle: each investment must serve members' interests, fit the portfolio, and be capable of being valued, monitored, and risk managed.

ATP runs an investment process with four gates, where the final investment decision is made at the last gate, as illustrated in Exhibit 6.29. Earlier gates allow the daily management to test the investment thesis, identify issues before full due diligence costs are incurred, and stop a case if the investment does not meet ATP's requirements. The investment team owns the case, while risk management, valuation, tax, ESG, legal, and other relevant functions are involved during due diligence. A review team challenges the investment case and provides an internal counterweight to the deal team. For non-standard transactions, escalation is required, either to the CEO of ATP or ultimately the Supervisory Board of ATP. Non-standard transactions could include investments which implement new asset classes, include particular risks (such as reputational), or are simply large in size.

Initial screening	Analysis	Due diligence	Decision	Implementation
- Investment case is received or idea generated - Relevant information is gathered 'Proof of concept'	- Analysis of investment case - Planning of Due Diligence process - Involve relevant teams	- Evaluation of - Business case - Investment risks - Commercial risks - Legal risks - Tax related risks - Operational risks	- Negotiations - Legal documents and terms - Outline operational implementation - Recommendation for CIO, CRO & COO	- Final negotiations and legal documentation given mandate in Gate 4 - Closing - Final operational implementation and control
Investment team	- Investment team - Legal - Tax - ESG - Valuation - Risk management - Portfolio construction - Treasury - Operations	- Investment team - Legal - Tax - ESG - Valuation - Risk management - Portfolio construction - Treasury - Operations	- Investment team - Legal - Tax - ESG - Valuation - Risk management - Portfolio construction - Treasury - Operations	- Investment team - Operations
	GATE 1	GATE 2	GATE 3	GATE 4
DECISION TO MOVE TO NEXT PHASE & GATE	Investment team	Investment Forum (+ briefing to CIO, CRO & COO)	Investment Forum	Investment Forum + CIO, CRO & COO

Exhibit 6.29: ATP's investment process. The exhibit illustrates the ATP investment process and the gates in the process. The top row shows the investment process phases, the next row the typical tasks associated with the phases, and the third row lists the teams involved. The final row shows where the decision to move to the next phase and gates lies.

6.9.4 Risk management

Risk management is an especially important part of the investment process for ATP because it is a risk-based investor. Risk management provides the daily measurement and control system that connects the Supervisory Board's limits to ATP's actual balance sheet. ATP marks the full balance sheet to market daily and measures risk daily using the same official risk model that is used to assess compliance with Supervisory Board limits, portfolio risk targets, and factor targets. The liquid pool is traded so that the total portfolio remains aligned with the approved risk and factor allocations, while the illiquid pool is monitored through PME risk measures (see also Section 6.7).

The main risk measure is Expected Shortfall at a 99 pct confidence level over a three-month horizon, ES(99 pct, 3M), as introduced and defined in Section 6.5. The measure is calculated on a static balance sheet with zero expected market return, which makes it conservative relative to an approach that assumes active de-risking or positive expected returns during the risk horizon. This measure is used for market risk in the Risk-seeking Portfolios and for the Supervisory Board's overall risk tolerance.

ATP's total risk consumption aggregates several risk categories. Market risk captures changes in public and private-market exposures, including the look-through public-market-equivalent risk of illiquid assets. Longevity risk captures the effect of members living longer than expected and is measured using ATP's mortality model. Operational risk captures losses from failed processes, people, systems, or external events. Counterparty risk measures potential losses from counterparty default, taking account of actual exposures, legal agreements, collateral, transfer risk, and pre-settlement risk. These components are aggregated through a correlation matrix to produce total risk consumption for the balance sheet.

Longevity risk is important because the liabilities are lifelong pensions. If people live longer, the extra pensions paid to people with greater longevity must be funded by the Bonus Potential. Currently, longevity risk corresponds roughly to 2 pct of the pension liabilities. The estimate of longevity risk is based on ATP's internally developed mortality model, SAINT.

Asset liability management (ALM) is an important part of the full evaluation of the long-term implication of the investment strategy. ATP has an in-house ALM model addressing the most important risks for ATP, such as market and longevity risk, but also management actions such as liability hedging, investment in the risk-taking portfolio and bonus decisions. The output of the model is used to balance multiple objectives, such as expected pensions, pension-at-risk, risk of low solvency, and likelihood of bonuses exceeding inflations.

Liquidity and collateral risks are monitored daily and is subject to Supervisory Board limits.

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Liquidity and collateral management are subject to Supervisory Board limits in a model which operates on a *Liquidity Coverage Ratio (LCR)*. The LCR measures the high-quality liquid assets relative to the total net outflows. ATP's LCR measure considers the stressed available cash and collateral, as well as the stressed outflows and collateral calls. The ATP approach stresses the numerator and denominator separately to have a conservative number. In addition, multiple horizons ranging from 1 day to 3 months are considered.

Chapter 7

Evaluation of investment strategy

ATP's investment strategy should be evaluated by the pension payments it generates. The pension payments must be seen relative to the role that ATP has in the Danish pension system. It is tempting to compare the return on ATP's investments to those of other investors. However, these other investors are unlikely to be subject to the same restrictions on their investments as ATP. While these comparisons may be interesting and provide some bearing, they cannot be the primary way to assess ATP's performance. A more complex analysis is required.

We consider ATP's performance from many different angles to evaluate both the overall investment strategy and its sub-components. We begin by reviewing the capital market dynamics over the last decades to understand the environment for ATP's investment strategy. We then evaluate ATP's performance using general metrics such as pension at risk and wealth accumulation. We also evaluate the factors, the investment pools, and the sub-portfolios. The evaluation of the sub-portfolios has the advantage that it is easier to compare to benchmarks but has the disadvantage that it only provides part of the total picture. Finally, we conduct in-depth analyses on the following topics: leverage, the allocation to illiquid assets and to Danish equities, the performance in 2022–23, currency hedging, new business model, peer comparisons and ATP's costs.

7.1 Evaluation framework

Key message

The delivery of lifelong pensions is the primary criterion on which ATP is evaluated. The investment performance is a means to an end. The assets under management (AuM) move with interest rates and liability valuations in ways that do not purely reflect investment success or failure. Nevertheless, we compare ATP's overall balance sheet and

Key message (continued)

sub-portfolio performance against several common reference portfolios: global equities, global fixed income, 60-40 equity-fixed income, and levered 60-40.

The purpose of ATP is to provide lifelong pensions for its members, and therefore this should be the primary criterion on which ATP is evaluated. In this section, we outline the framework we use for the rest of the chapter for the evaluation of investment strategy: what we evaluate against, what we deliberately do not infer, and what elements we can quantitatively or qualitatively assess.

Investment performance is a means to an end; the investment strategy supports the pension promise. ATP's purpose is to deliver guaranteed lifelong pensions and to build the capacity to grant future bonus increases. This framing follows directly from the purpose of long-term institutional investing and liability-driven portfolio choice described in theory (Section 4.1), the balance sheet items that enable ATP to deliver on this pension promise (Section 5.5), and the investment strategy and risk appetite adopted by ATP to meet the guarantees, harvest rewarded sources of return, and to support future bonus allocations (Chapter 6).

Since ATP is a liability-driven investor, the assets under management (AuM) move with interest rates and liability valuations in ways that do not purely reflect investment success or failure. This is especially the case when ATP's balance sheet expanded through the long decline in interest rates from the early 2000s to 2021 and contracted in 2022 when rates rose sharply (see Sections 7.2 and 7.5); neither movement is solely an investment outcome. Likewise, ATP has not adopted formal benchmarks, making traditional alpha comparisons (following Jensen, 1968; Roll, 1978; Fama and French, 1993) hard to interpret. This does not mean ATP's investment performance cannot be quantitatively evaluated; it means the quantitative performance measures are incomplete and should be interpreted for scale and comparison, rather than representing formal measures of outperformance.

Nevertheless, we compare ATP's overall balance sheet and sub-portfolio performance against several common reference portfolios: global equities, global fixed income, 60-40 equity-fixed income, and levered 60-40. These references are transparent, recognizable, investable at scale and at low cost, and are commonly used as a reference point for diversified institutional portfolios (Ang, 2012). Although we do use the term "benchmark" because these portfolios are often selected as institutional benchmark portfolios, they are not formal benchmarks in the sense that they have been adopted by ATP. The reference benchmarks have important caveats: they do not hedge ATP's guaranteed liabilities, measure ATP's risk targets, capture the interaction between the Interest Rate Hedge Portfolio and the Bonus Potential (BP), or reflect ATP's liquidity

and governance constraints. Data availability varies by portfolio and period with ATP-wide return data available from 2002, the pure Investment Portfolio (INV) from 2008, the Market Return Portfolio (M) from 2022, and the Supplementary Hedge Portfolio (SAP) from 2023. We report periods consistent with the data available.

ATP's investment staff has been instructed to follow target risk levels and keep the risk levels within approved limits, as discussed in Section 6.5. Thus, a central test of the implementation of investment policy is to test ex-post risk statistics versus ex-ante risk targets across the various portfolios, which we examine in Section 7.5. This implementation is distinct from achieving high realized returns. An investment strategy can be implemented faithfully at desired risk levels but still deliver poor returns if the risks taken perform poorly. Conversely, high ex-post returns do not mean that the intended risk strategy was successfully followed. Therefore, our evaluation considers both risk-target implementation and cumulative performance.

The evaluation is done both quantitatively and qualitatively. Quantitative evaluation includes pension projections, asset and liability model (ALM) assessments, pension-at-risk, solvency probabilities, realized returns, factor exposures, leverage, illiquidity share, and costs. Qualitative evaluation is also necessary because several important choices cannot be summarized by performance statistics. We qualitatively assess ATP's investment beliefs (Section 7.3), the rationale for the Danish equity overweight (Section 7.7.2), and lessons learned with illiquid investments (Section 7.7.3).

7.2 Market backdrop

Key message

ATP's investment performance can only be understood in the context of a market environment in which there have been significant developments.

The level of long-term interest rates is the most important market variable for understanding the evolution of ATP's guaranteed liabilities. The long period of falling yields abruptly ended in 2022. Global equity markets delivered strong overall long-run returns over the evaluation period, but there has been substantial regional variation and periodically severe drawdowns.

It is important to consider the co-movements of equities and bonds because both are major components of the Risk-seeking Portfolios and because the diversification between them is a key determinant of overall portfolio performance. During much of the period from the late 1990s through 2021, stock-bond correlations were often negative or only

Key message (continued)

modestly positive, which made bonds an effective diversifier in multi-asset portfolios. 2022 stands out as a historic outlier in the joint distribution of equity and bond returns—indeed, it was the worst year for US bonds in over 250 years of financial history, and one of the rare years in which large losses on both asset classes occurred simultaneously.

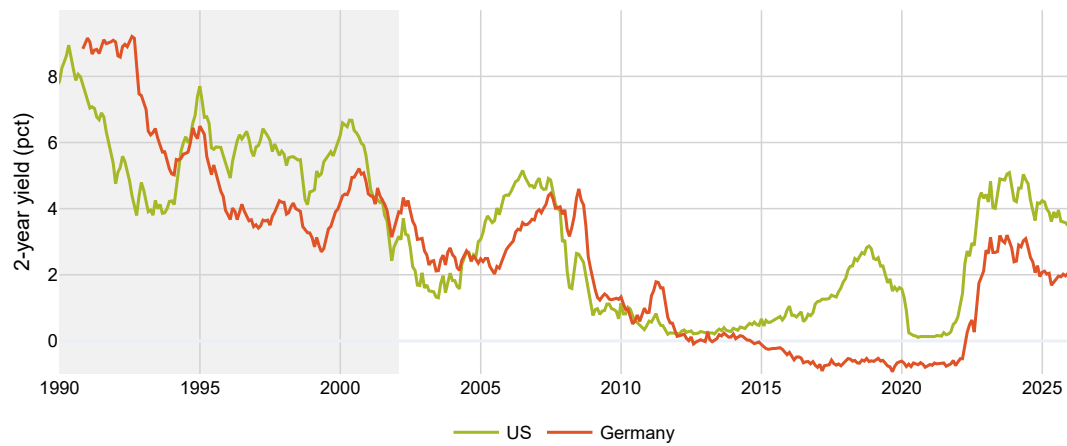
The evaluation of ATP's investment performance can only be understood in the context of a market environment in which there have been significant developments. For ATP, the two most important external market drivers are interest rates, because they drive the value of guaranteed liabilities and the Interest Rate Hedge Portfolio, and equity returns, because they are major drivers of the returns in the Risk-seeking Portfolios. There have been fundamentally different market regimes—a three-decade era of falling interest rates and strong asset returns, major equity market crashes in the Global Financial Crisis (GFC) in 2008 and during Covid in 2020, and a sharp and simultaneous decline in both equities and bonds in 2022.

In the sections below, when long history of US returns is presented, they are in US dollars. When global results are presented, returns are hedged into Danish kroner.

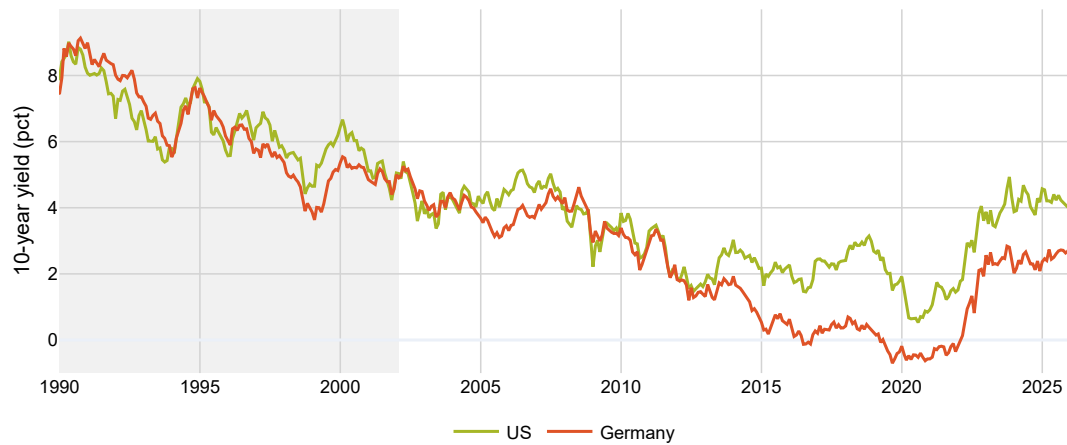
7.2.1 The fall and rise of interest rates

The most important market variable for understanding the evolution of ATP's guaranteed liabilities is the level of long-term interest rates. Exhibit 7.1 shows the evolution of 2-, 10-, and 30-year yields in the US and Germany since 1990. From 1990 until around 2020, long-term interest rates declined from levels near 9 pct to around zero, and at times even below zero in Europe. The decline was especially large after 2002, which is when ATP moved to mark-to-market valuation of its liabilities (Section 5.5.4). (The shaded area in Exhibit 7.1 reflects the pre-2002 period, prior to mark-to-market accounting.) Over this period, the secular fall in long-term rates mechanically increased the market value of ATP's guaranteed liabilities and created a powerful tailwind for fixed income returns.

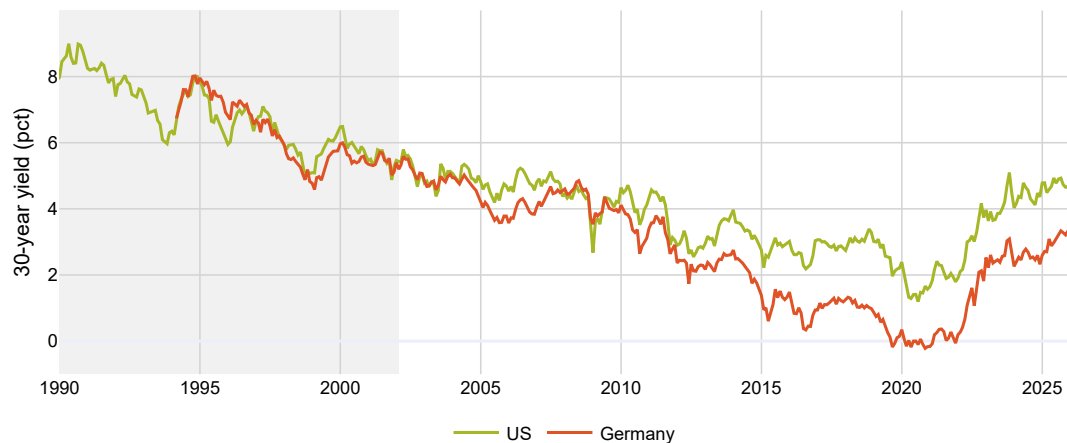
Review of ATP's Investment Strategy



(a) 2-year yields



(b) 10-year yields



(c) 30-year yields

Exhibit 7.1: Interest rate developments since 1990. The figures illustrate the development in US and German interest rates since 1990. Panel (a) shows the 2-year yield, Panel (b) shows the 10-year yield, and Panel (c) shows the 30-year yield. The grey shaded area reflects the period prior to 2002 when ATP did not apply mark-to-market valuation of its liabilities.

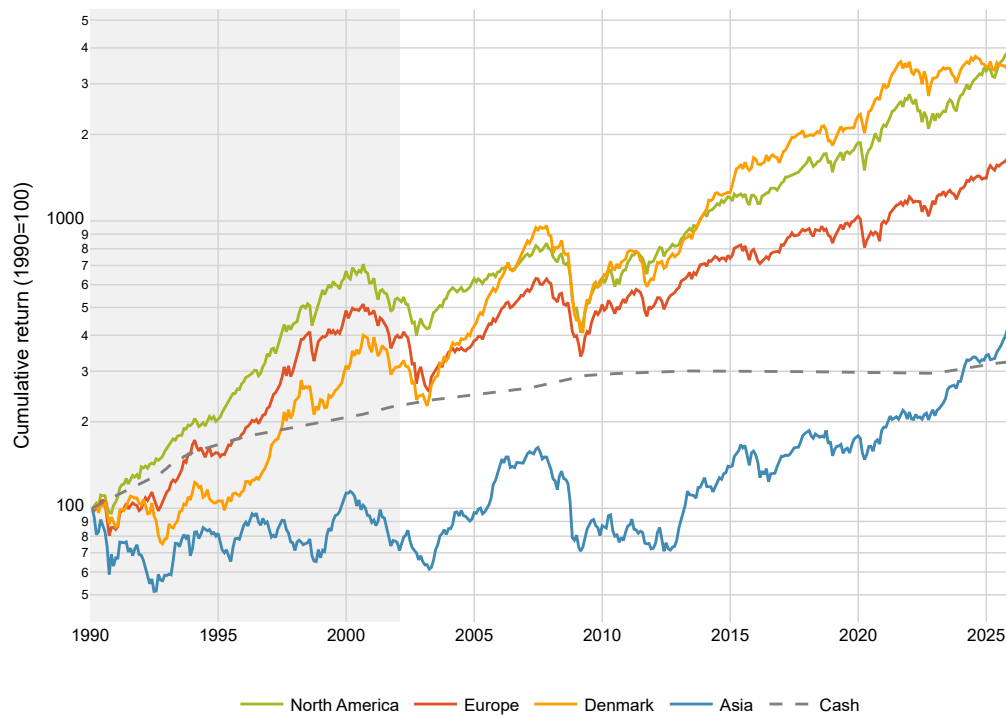
The long period of falling yields abruptly ended in 2022. In response to the resurgence of inflation corresponding to the re-opening of the global economy after the Covid pandemic and the rapid increase in energy prices due to Russia's invasion of Ukraine in February 2022, central banks tightened monetary policy (Pflueger, 2025). Policy interest rates increased by approximately 3 percentage points. Not surprisingly, short-term interest rates rose sharply, and long-term yields sharply increased. For a pension fund, the rise in long-term interest rates was particularly important, because these rates are most relevant for discounting long-dated guaranteed liabilities. The sharp increase in yields in 2022 therefore reversed part of the earlier increase in the market value of liabilities. In broad terms, the long decline in rates from 2002 to 2021 helps explain why the value of ATP's guaranteed obligations rose so substantially over that period, while the rate increase from 2022 onward helps explain why the market value of those liabilities subsequently declined.

7.2.2 Equity markets

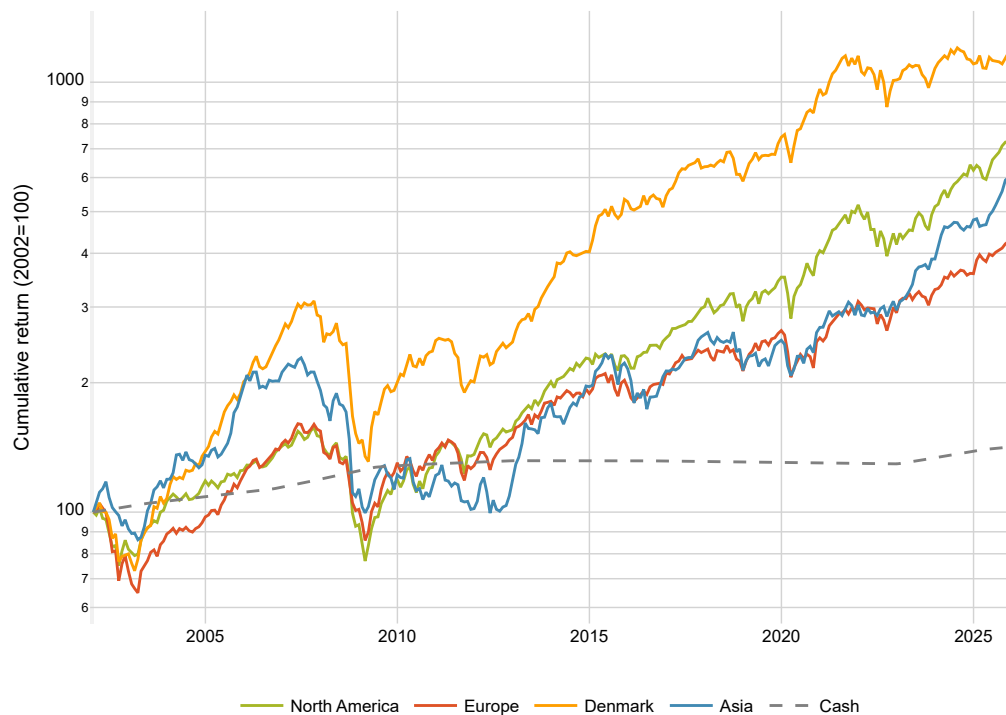
Global equity markets delivered strong overall long-run returns over the evaluation period, but there has been substantial regional variation and periodically severe drawdowns. Exhibit 7.2 reports cumulative equity returns since 1990 in Panel (a) and since 2002 in Panel (b) across the major geographic regions relevant for ATP's Risk-seeking Portfolios—North America, Europe (excluding Denmark), Denmark, and Asia. The return of a DKK cash deposit is also included. All returns are hedged into DKK.

Since 1990, all major regions delivered substantial positive excess equity returns relative to cash. North American equities generated the highest cumulative return, although Danish equities performed exceptionally well and for much of the period led the ranking. It is highly unlikely that any ex ante framework would have confidently predicted Danish equity outperformance of this magnitude or duration prior to 1990. Asian equities, by contrast, underperformed significantly—driven primarily by Japan's prolonged stagnation—and have only recently moved into positive excess return territory. This dispersion across regions underscores a general point about equity investing: the identity of the best-performing market is highly sensitive to the choice of starting date and is far easier to identify in hindsight than in advance.

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(a) 1990–2025



(b) 2002–2025

Exhibit 7.2: Equity market returns. The figures present the cumulative equity returns since 1990 in Panel (a) and since 2002 in Panel (b), across the major geographic regions. Note, the axis is base-10 logarithm to better illustrate the relative performance.

There are several sharp equity market crashes contained in the overall strongly positive performance of equities. There were major drawdowns during the collapse of the dot-com bubble in the early 2000s, the GFC in 2008, and the sharp market fall at the onset of the Covid pandemic in 2020. During the GFC, global equities fell by almost 50 pct from peak to trough. During Covid, markets fell sharply but recovered rapidly over the course of a few months due to substantial policy interventions by governments and central banks around the world. These episodes are excellent illustrations that the equity premium is earned only by bearing substantial interim losses and periods of prolonged underperformance (see Section 4.2.1). For an institutional investor such as ATP, Exhibit 7.2 highlights that performance must be judged over long horizons and in the context of the prevailing market regime, rather than by focusing on individual crisis years in isolation. Further, there are significant timing effects—it is easy to identify excellent equity performances in hindsight, but it is much harder to identify the best markets beforehand.

7.2.3 Stock and bond movements in crisis years

It is important to consider the co-movements of equities and bonds because both are major components of the Risk-seeking Portfolios and because the diversification between them is a key determinant of overall portfolio performance (see Section 4.4.1). Exhibit 7.3 reports annual equity and bond returns for a US investor and a global investor. Several years stand out. Equity market crashes are evident in 2002, the final year of the dot-com collapse, and 2008, in the middle of the GFC. The two other notable years are dominated by bond losses: 1981, when the Federal Reserve practiced monetary targeting to dampen high inflation and monetary tightening reached its peak, and 2022, when central banks aggressively raised rates to combat post-pandemic inflation. In 1981 and 2022, equities offered little diversification against bond losses. The 2022 episode was especially severe: both equities and bonds recorded large simultaneous losses, a combination that proved painful for any portfolio holding meaningful allocations to both.

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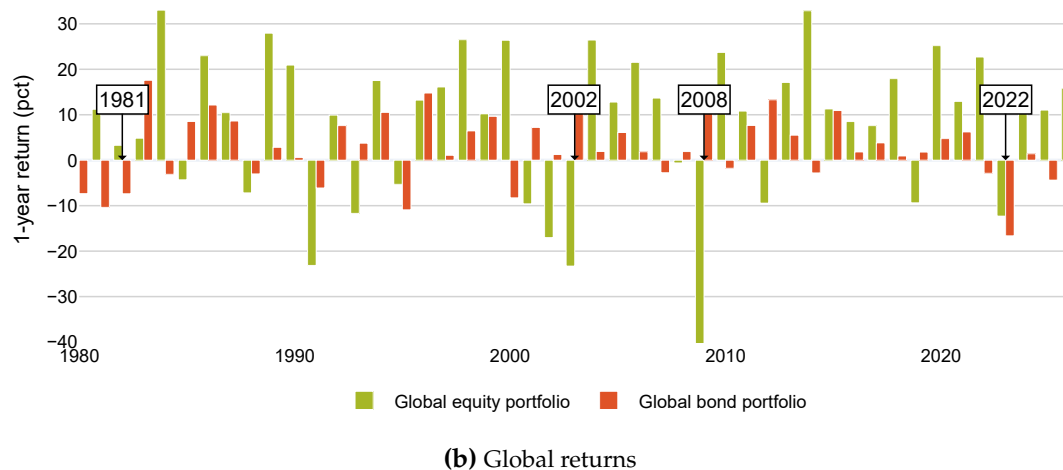
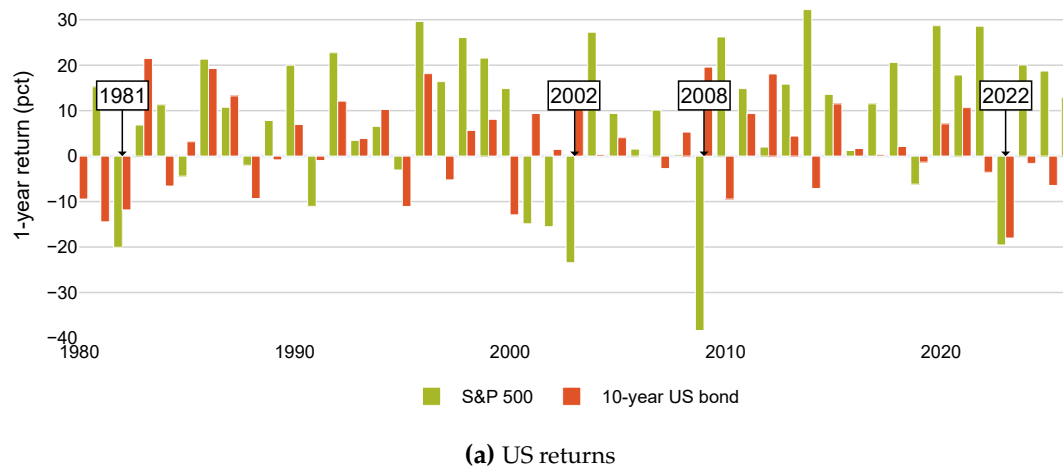
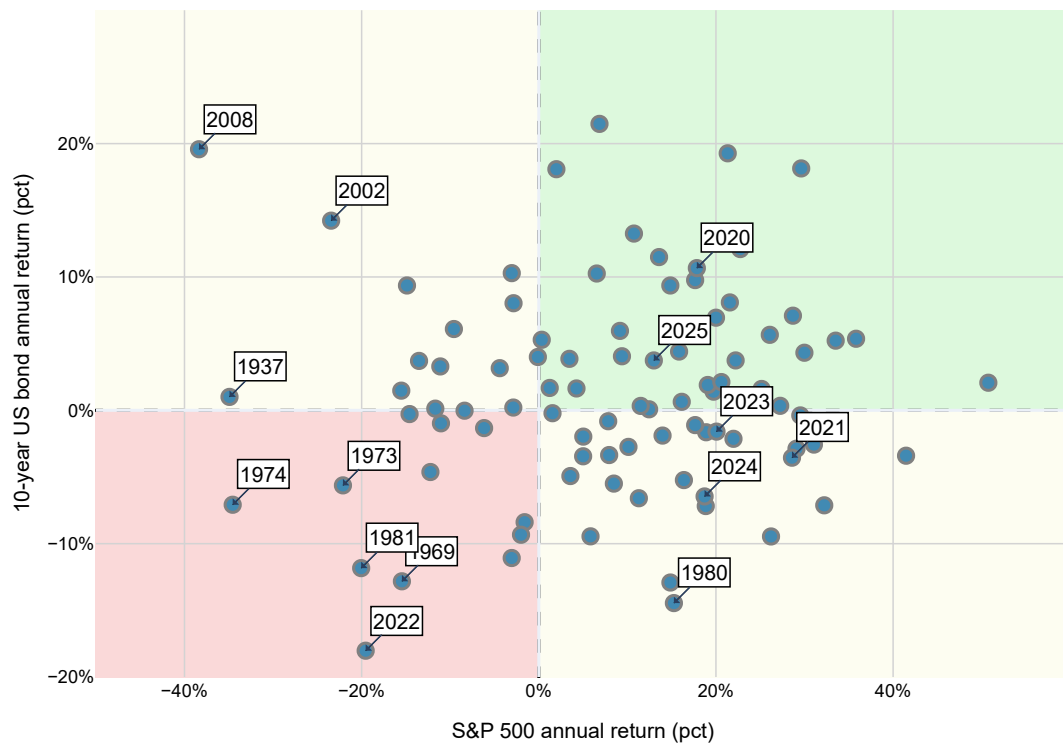


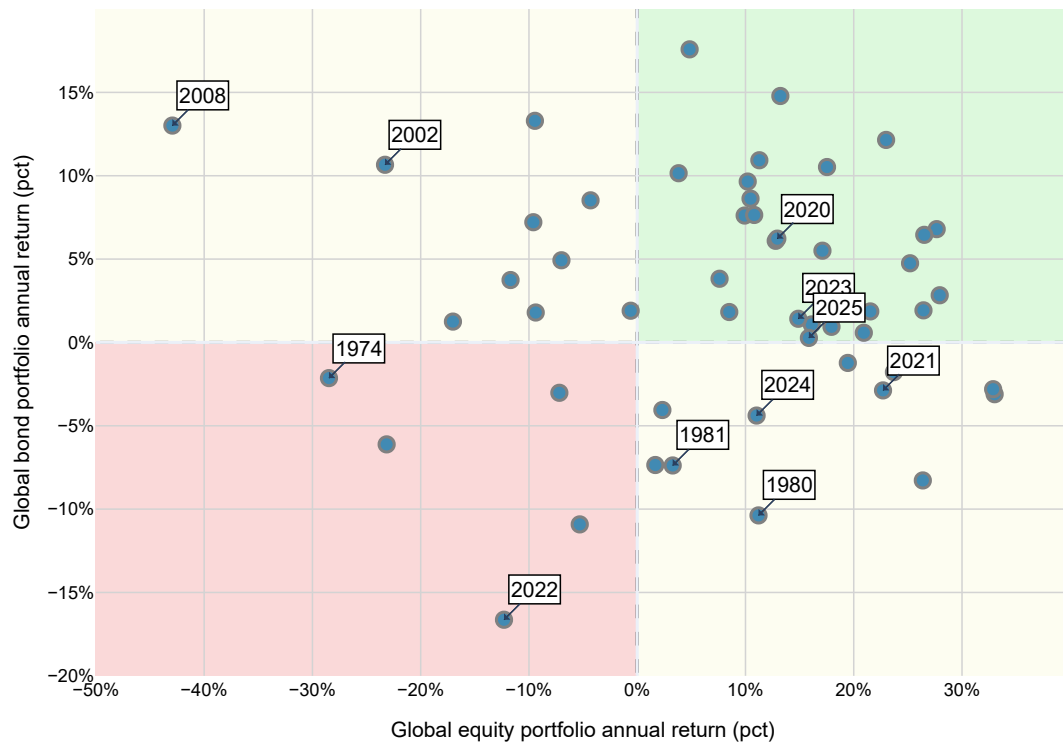
Exhibit 7.3: Equity and bond returns. The figure illustrates the annual equity and bond returns since 1980. Panel (a) illustrates the returns for US portfolios and Panel (b) illustrates the returns for global portfolios.

In fact, 2022 stands out as a historic outlier in the joint distribution of equity and bond returns—indeed, it was the worst year for US bonds in over 250 years of financial history (McQuarrie, 2024a), and one of the rare years in which large losses on both asset classes occurred simultaneously. Exhibit 7.4 shows the same relationship as Exhibit 7.3 but in a different form, plotting annual equity returns on the horizontal axis against annual bond returns on the vertical axis, for a US investor since 1936 in Panel (a) and a global investor since 1974 in Panel (b). The top right quadrant is colored green to emphasize positive returns on both equities and bonds, and the bottom left quadrant is colored red for negative returns on both equities and bonds. The scatterplot shows that 2022, with large bond *and* equity losses, is an outlier: While some earlier years, particularly in the inflationary 1970s and early 1980s, also saw negative bond returns, those episodes were typically accompanied by more modest equity declines or even positive equity performance.

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(a) US equity and bond returns



(b) Global equity and bond returns

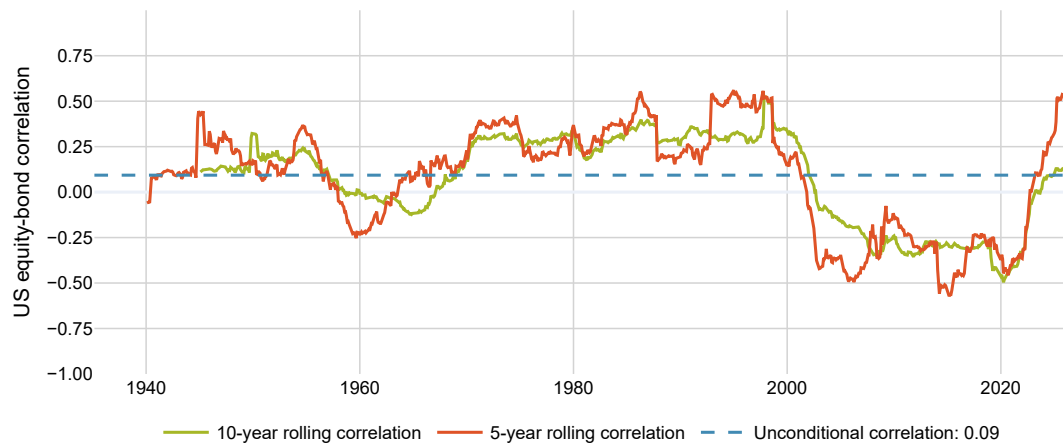
Exhibit 7.4: Co-movement of equity and bond returns. The figure illustrates the relationship between annual equity and bond returns. Panel (a) shows the returns for a US-based investor since 1936 and Panel (b) shows the returns for a global investor hedged into DKK since 1974. The shaded area highlights the state of portfolio returns in the given area: green is positive returns on both equities and bonds, yellow is positive return on either bonds or equities and red is negative returns on both bonds and equities.

7.2.4 Stock-bond correlations

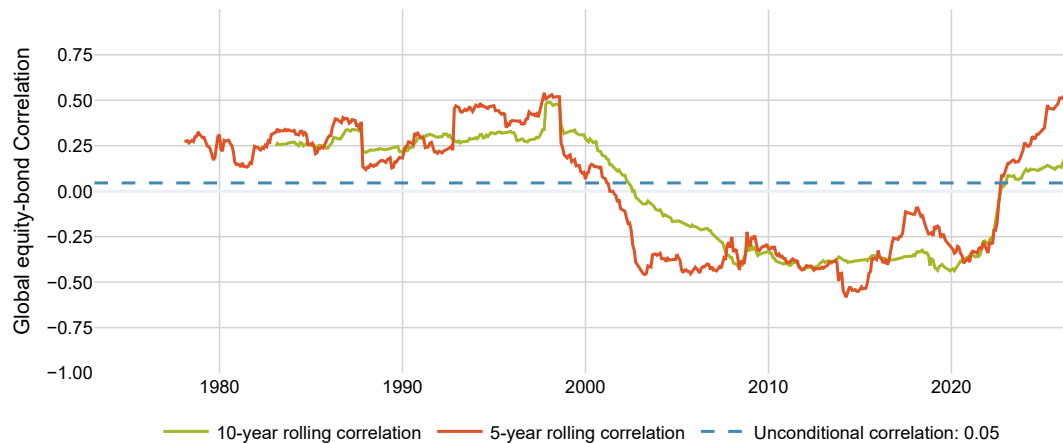
The time-varying correlation between equities and bonds is the key mechanism underlying the diversification failures of 2022—and the stock-bond correlation has fluctuated over time, with important consequences for portfolio construction. Exhibit 7.5 plots the rolling 5- and 10-year correlations between equity and bond returns alongside the unconditional long-run correlation, for a US investor since 1936 in Panel (a) and a global investor since 1974 in Panel (b). The average correlation is close to zero over both samples, which is often cited as the theoretical foundation for holding equities and bonds together in a portfolio. But this average conceals wide fluctuations: correlations have ranged from approximately +0.3 to −0.3 over the sample, and the transitions between regimes can be rapid. This has implications for the diversification that bonds can offer portfolios. In periods with high correlations there is less diversification. However, a correlation of 0.3 would typically offer better diversification than between different equity markets.

During much of the period from the late 1990s through 2021, stock-bond correlations were often negative or only modestly positive, which made bonds an effective diversifier in multi-asset portfolios. What made a balanced portfolio work during the GFC of 2008 and the Covid shock of 2020 was that the negative stock-bond correlation meant bonds acted as a diversifier to poor equity performance. More recently since 2022, the stock-bond correlation has turned positive. [Campbell, Pflueger, and Viceira \(2020\)](#) and [Campbell, Pflueger, and Viceira \(2025\)](#) attribute this shift from the negative correlation regime to positive to the shift in the dominant macroeconomic risk from growth to inflation. What made 2022 so challenging was not just that bond losses were unusually large, but that the correlation between equities and bonds rose at the same time, so that the normal diversification mechanism largely failed. The fact that the stock-bond correlation is now positive does not mean balanced strategies are not valid; stock-bond correlations have been positive in the past—Exhibit 7.5 shows that from the 1960s to the late 1990s, equity-bond correlations were predominantly positive and diversified strategies performed well during these times. Nevertheless, the time-varying correlations re-emphasize that long sample periods are necessary to evaluate performance.

Review of ATP's Investment Strategy



(a) US stock and bond returns



(b) Global stock and bond returns

Exhibit 7.5: Rolling equity-bond correlations. The figure illustrates the correlations between equities and bonds, both as an average correlation and rolling 5- and 10-year correlations on monthly returns. Panel (a) illustrates the correlations for a US investor since 1936 and Panel (b) illustrates the correlations for a global investor hedged into DKK since 1974.

7.3 Evaluation of ATP's investment philosophy

Key message

ATP's investment beliefs are coherent, its investment implementation is consistent with those beliefs, and they broadly reflect economic theory and empirical evidence—with an exception for illiquid markets. While ATP's investment philosophy is internally consistent, it leads to a portfolio that is differentiated, complex, potentially difficult to benchmark, and can result in performance very different from peers. Although peer risk should not drive the portfolio, it is a real risk that should be managed through clear communication and governance.

ATP's investment beliefs connect its investment strategies and portfolio construction to its

pension promise, financial market structure, and social purpose. In this section, we evaluate the investment beliefs stated in Section 6.1. We assess whether the beliefs are internally coherent, supported by financial theory and empirical evidence, and appropriately reflected in ATP's investment approach. Overall, we find ATP's investment philosophy broadly consistent with modern portfolio theory and similar to the way other large pension funds articulate theirs (Clark and Urwin, 2008; Koedijk and Slager, 2010; Ambachtsheer, 2016). We organize the discussion around the same categories used in Section 6.1: beliefs regarding financial markets, beliefs based on the ATP product, beliefs based on ATP's role in Danish society, and further investment implications of ATP's investment beliefs. We also comment on ATP's ESG policy.

7.3.1 Beliefs regarding financial markets

ATP's first group of beliefs articulates the foundations of modern portfolio theory as they apply to a long-horizon institutional investor: that an appropriate level of risk is the first-order decision, that diversification is the only free lunch, that compensated risk comes from a limited number of factors, that strategic asset allocation matters more than tactical asset allocation, and that markets are on average efficient. All of these beliefs are well-supported in the academic literature, as discussed in Chapter 4.

Factors and risk parity

ATP combines a factor-based investment approach with a risk-parity allocation framework. This combination is not unique and is also employed by other large institutional investors. (See Section 4.5.2 on risk parity strategies.) ATP does not treat asset classes as ends in themselves, but instead uses asset classes as implementation vehicles for broader underlying factors—the Equity factor, Rates factor, Inflation factor, and the Other factor that includes alternative risk premiums (or style premiums), which we describe below. This aligns the portfolio construction with the economic forces driving returns, rather than allocating capital to across asset classes. The increasingly popular Total Portfolio Approach, discussed in Section 4.5.5, can be interpreted as a two-factor asset allocation model, with the factors being equity and bond returns which overlap with ATP's Equity and Rates factors (Section 6.3).

ATP's combination of a factor-based investment approach and a risk-parity allocation framework increases both portfolio complexity and the challenge of communicating performance to external stakeholders. The factor-based approach relies on models to identify and measure broad sources of risk and return, while the risk-parity framework often requires leverage and derivatives to scale low-volatility factors to their desired risk contribution. As a result, the portfolio can depart materially from conventional market-capitalization benchmarks, making performance more difficult to interpret and compare. Section 6.3 covered ATP's internal ev-

idence, including cluster analysis, long historical backtests, along with other robustness tests that support harvesting a relatively small number of broad factors. However, a belief that return premiums result from a limited number of factors does not, on its own, guarantee that those factors will have a positive return in every year or even every decade.

The belief that diversification is the only free lunch should not be interpreted as implying that diversification always pays off. Diversification reduces idiosyncratic risk and improves the risk-return trade-off in normal market conditions, but the magnitude of the benefit varies across regimes; diversification is a long-run, unconditional statement. Cross-asset correlations rise sharply in market downturns (Longin and Solnik, 2001; Ang and Chen, 2002), and the equity-bond correlation, which is a major driver of diversification (Section 4.4.1), varies over time. Section 7.2 showed that bonds diversified equities during the GFC and Covid shocks, but not in 2022, when inflation risk dominated growth risk, both equity and bond returns were negative, and the equity-bond correlation rose sharply (Exhibit 7.5). This does not invalidate ATP's belief in diversification; it clarifies what diversification can and cannot deliver.

*The 2022 episode was interpreted as a failure of risk parity, and the criticism is understandable, with wide-spread commentary from practitioners and coverage in the financial media.*⁸⁴

When both equities and bonds fell sharply, a levered diversified portfolio of bonds and equities underperformed an unlevered 60-40 equity-bond portfolio. Note that a 60-40 portfolio itself did badly because stocks and bonds had severely negative returns (Section 7.2.3 and Exhibit 7.4). But risk parity did even worse because it holds more long-duration bonds than a 60-40 portfolio and levers the resulting portfolio to a higher target volatility; when equities and bonds fall together, the leverage that was supposed to magnify diversification benefits instead magnified losses. However, ATP's Inflation factor outperformed in 2022 when Equities and Rates factors did not (Section 6.3.2 and Exhibit 6.6), and ATP's return would have been worse without the diversifying effect of the Inflation factor (see below in Section 7.5). The 2022 episode did not invalidate ATP's factor-based and risk parity framework. But it does underscore two things: that risk parity's efficiency advantage over 60-40 depends on specific conditions—a low risk-free rate and low equity-bond correlations—and that leverage, while it lets an investor scale a diversified portfolio efficiently to a target volatility, can also amplify short-term losses (Sections 4.4 and 6.3). It also showed that only targeting risks, without having a forward view on expected returns, can leave a portfolio overexposed to factors whose expected compensation has become temporarily low or whose diversification properties have decreased. ATP has a comparative advantage in investing over the long term, and it consistently stayed the course in maintaining its factor-based risk exposures through major drawdowns of the evaluation pe-

⁸⁴See, for example, Bloomberg (2022). John Authers, then a Bloomberg columnist, referred to risk parity having an "existential crisis" (see Authers, 2024). For an academic reference, see Brixton et al. (2023).

riod, including the GFC, the Covid shock, and the 2022 drawdown (see Section 7.5 below).

Importance of strategic asset allocation

*The belief that strategic asset allocation is more important than tactical asset allocation is well supported throughout the literature, including estimates of strategic asset allocation accounting for over 99 pct of Norway's Government Pension Fund Global's returns (Ang, Goetzmann, and Schaefer, 2009).*⁸⁵ The belief that markets are on average efficient—the “efficiently inefficient” formulation of Pedersen (2015)—is consistent with the equilibrium implications of Grossman and Stiglitz (1980), where market participants may earn a small return from costly information acquisition but not at large scale, and with the empirical literature documenting that the average active manager does not outperform a benchmark net of fees (see Section 4.4). This belief is reflected in ATP's selective approach to active risk and tactical asset allocation where ATP has a demonstrable institutional advantage, such as derivatives expertise, its balance-sheet structure, or knowledge of Danish markets.

Beliefs regarding illiquid assets

The belief that warrants the most careful evaluation is, in our view, ATP's belief that private market assets make a positive contribution to a portfolio. Theoretically, it is true: if markets are incomplete, then private markets may provide access to opportunities that are not available in public markets (see Section 4.3). Investors should be compensated for bearing additional risks in private market investments for illiquidity, adverse selection, and asymmetric information (Metrick and Yasuda, 2010). In practice, as Section 4.3.4 emphasizes, private markets have high fees, are difficult to evaluate, valuations are smoothed, and performance depends heavily on vintage, manager selection, governance rights, and bargaining power. In our view, the academic evidence does not support the statement that private markets reliably outperform public markets after fees and adjusting for risk. The early evidence, like Kaplan and Schoar (2005) and Harris, Jenkinson, and Kaplan (2014) found outperformance of Private equity, but performance has significantly worsened after the financial crisis (Harris et al., 2023). In addition, private-market cash flows are also procyclical, which may create pressure for capital calls for private market investments when stocks and bonds perform poorly (Robinson and Sensoy, 2016).

The mixed evidence on average private-market outperformance does not imply that ATP should avoid illiquid investments. Private markets may provide access to companies and projects that are increasingly less available in public markets, as firms can now raise substantial private capital and remain private longer before listing, if they list at all (Doidge, Karolyi, and Stulz,

⁸⁵See Brinson, Hood, and Beebower (1986), Ibbotson and Kaplan (2000), and Xiong et al. (2010).

2017; Ewens and Farre-Mensa, 2020). Since the dispersion of private-market returns is high and performance is persistent, there is opportunity to add value if there is skill—but it accrues disproportionately to investors with privileged access (Lerner, Schoar, and Wongsunwai, 2007). ATP also approaches investments in private markets in a way that mitigates the smoothed valuations that artificially boost measured diversification benefits and returns of illiquid assets, using public market-equivalent metrics and factor exposures (see Sections 6.3 and 6.6).

ATP's own track record suggests that the belief that private markets are value-enhancing should be stated cautiously. We show below that a large share of ATP's illiquid portfolio was acquired during 2017–2019 when fund raising in private markets was high. Since then, ATP has intentionally reduced the size of the illiquid portfolio. Section 7.5.1 shows that over 2001 to 2025, ATP's illiquid portfolio has outperformed a 60-40 equity-bond benchmark, but it underperformed over 2020 to 2025. This does not mean that this belief is wrong: it is an ex-post outcome over a decade, but it can be inferred that ATP's investment experience may have meant the initial assumptions supporting illiquid investments were too optimistic. Illiquidity and complexity per se are not automatically sources of return. We endorse ATP's use of a public market equivalent (PME)-approach to its illiquid investments. The PME is the metric that academics most favor (see Section 4.3.4), and the metric highlights when illiquid investments outperform public-market-equivalent investments to justify the risk, fees, concentration, and other risks of private markets.

7.3.2 Beliefs regarding the ATP product

ATP's decision to hedge the interest rate risk of liabilities is the bedrock principle leading to separation of the investments into the Interest Rate Hedge Portfolio and the Risk-seeking Portfolios. Following economic theory in Section 4.1, ATP centers its portfolio on its liabilities. This motivates ATP's two-portfolio architecture outlined in Chapter 6—first build a portfolio to hedge the liabilities (Section 6.2) and then an Investment Portfolio seeking returns (Section 6.3). The literature discussed in Chapter 4 shows that for an investor with long-dated liabilities, the appropriate risk-free asset is not cash but a portfolio that replicates the cash-flow profile of those liabilities, and that the investment problem reduces to an optimization over the surplus (assets minus liability-replicating portfolio, see Section 4.1.1) rather than over asset returns in isolation. ATP's two-portfolio structure is thus the most important result of this investment belief. We show, below, that ATP has been successful in managing its Interest Rate Hedge Portfolio, especially since the markets for long-duration assets have relatively fewer financial instruments available and less liquidity.

The recent market backdrop reinforces the importance of ATP's product-based investment beliefs of hedging the guaranteed liabilities. Section 7.2 showed that the low-rate environment

increased the value of guaranteed liabilities and the Interest Rate Hedge Portfolio grew alongside the rising present value of the liabilities it was designed to match. In 2022, the rise in rates sharply reduced both bond prices and liability values. These movements are difficult to interpret without considering the Interest Rate Hedge Portfolio: losses on the Interest Rate Hedge Portfolio can be appropriate when they offset changes in guaranteed liabilities, and the capacity to take risk depends on the Bonus Potential rather than on AuM alone.

We agree that ATP has a comparative advantage in possessing long-term capital through its product design. ATP faces no liquidity demands that other institutions are subject to: investors can withdraw from open-end mutual funds (Coval and Stafford, 2007), banks are subject to runs (Diamond and Dybvig, 1983), clients can surrender their policies from insurance companies (Kojen and Yogo, 2022), and members of defined contribution (DC) funds are more likely to withdraw than members of non-DC funds (Sialm, Starks, and Zhang, 2015). Defined benefit plans also face liquidity demands from plan sponsors. By contrast, ATP receives non-withdrawable contributions. This allows ATP to employ leverage, to potentially hold a higher share of illiquid assets than similarly sized investors with shorter funding, and to pursue investment strategies, like risk parity, that institutions might find difficult without recourse to stable funding.

The ability of ATP to pursue countercyclical strategies (buying low when equity prices fall) is limited because of the structure of the guaranteed pension. While ATP has stable capital owing to its product design, it does not have an unconstrained risk budget. The Bonus Potential is the capital that is available to absorb losses and support future bonuses, and ATP must reduce risk when the Bonus Potential is impaired. This creates a delicate balance covered in Section 4.4.2, which discusses how tension can arise between protecting the guarantee and exploiting long-term investment opportunities. Protecting the guarantee requires a CPPI-like strategy, which sells when equity prices fall, whereas exploiting long-term investment opportunities requires the opposite—buying when equity prices fall. The introduction of Life Annuity with Market Exposure and the Long-term Supplementary Reserve has helped ATP place greater emphasis on the latter objective, but the fundamental tension remains: ATP can act as a long-term investor only to the extent that the Bonus Potential provides sufficient risk-bearing capacity. Further, the CPPI-like mechanism introduces path-dependence on the way de-risking and re-risking decisions are taken, as we comment below in Section 7.7.4. A final comment is that the cost of the guaranteed pension is a less flexible risk budget for ATP than an investor like an unconstrained sovereign wealth fund.

We agree that ATP has a comparative advantage in using liquidity from the Interest Rate Hedge Portfolio to employ leverage for the Investment Portfolio. Further, hedging long-duration

liabilities with physical bonds would absorb capital that could otherwise be deployed in return-seeking exposures. As Section 4.4 shows in theory, which is implemented in ATP's architecture discussed in Section 6.3, this allows ATP to operate closer to the tangency portfolio than is feasible for other investors who cannot lever or who must obtain leverage externally at a margin. Thus, this use of leverage is not available to investors without ATP's product features. Of course, managing leverage requires operational excellence—and in severe market dislocations like Covid and 2022, ATP had no operating errors in meeting margin or capital calls.

7.3.3 ATP's role in Danish society

ATP's role as a near-universal Danish pension institution creates investment responsibilities that are broader than those of a conventional asset manager. ATP invests on behalf of almost all Danes, and its portfolio decisions therefore have implications not only for risk and return, but also for legitimacy, transparency, cost efficiency, and the way ATP exercises ownership in Danish companies. In our view, ATP is correct to recognize that its social role affects investment strategy. This does raise policy and political implications that are beyond our mandate.

ATP's belief that it has a comparative advantage when investing in Denmark is plausible. ATP has a long history of investing in Danish markets, with local knowledge of Danish macroeconomic conditions, political institutions, companies, sectors, and governance practices. Its size and reputation may also give it access to co-investment opportunities and allow it to engage constructively with Danish listed companies. We show in Sections 7.6.4 and 7.7.2 that ATP has historically outperformed in Danish equities. The cost of concentration in Denmark is foregone diversification benefits in international markets. Going forward, a lower allocation to Danish investments is warranted unless ATP can continue to demonstrate that its local advantages translate into better risk-adjusted outcomes for members.

ATP is right to focus on investment and administration costs. The empirical asset pricing studies of active funds find, overall, that many active managers may outperform on a gross basis but underperform after fees (see Section 4.4.3). For an institution of ATP's scale running a mandatory and collective product on behalf of most of the Danish population, small differences in administrative or implementation costs translate into materially different pension outcomes over the relevant horizon. We find in Section 7.7.8 that ATP has low costs, in both absolute terms and relative to other large institutions. It is important to note that lowest cost implementation may not always be desirable, as certain asset classes and strategies require specialist skills—the important metric is to obtain high risk-adjusted returns after taking costs into account.

7.3.4 Further implications of ATP's investment beliefs

We agree with ATP that peer-relative performance should not drive strategic asset allocation.

ATP has a distinctive product, balance sheet, liability structure, and risk-bearing mechanism, and it should not follow the portfolios of institutions with different objectives and constraints. However, peer risk exists. Large deviations from peer performance can create legitimacy and communication risks even when the underlying portfolio is theoretically justified. (We discuss communication policy in Chapter 9.) If ATP has genuine comparative advantages in liability hedging, derivatives implementation, internal funding, and long-horizon investing, we believe it would be inappropriate to give up those advantages to reduce peer risk.

ATP's emphasis on diversification is well-founded in theory but also increases peer risk. Diversification across factors, geographies, asset classes, and other strategies moves an investor further away from market-cap weights (see Sections 4.4.1 and 6.3.4). ATP's belief in diversification also leads to ATP using risk weights to manage the portfolio, unlike most institutions who use capital (or dollar) weights. This leads to additional tracking error relative to market cap benchmarks, which can create periods of underperformance. This further exacerbates peer risk.

The belief that ATP should hedge uncompensated risk leads to ATP having 100 pct foreign currency hedge ratio. This is a consistent practice that results from beliefs: if currency risk is not expected to be rewarded over the long run, then ATP should not allow currency exposures to enter the portfolio. But, it is a stronger hedging position than that adopted by many institutional investors, who typically hedge most or all foreign-currency exposure in fixed income while leaving a meaningful share of foreign equity exposure unhedged (see Section 4.5.9). The difference matters because a full currency hedge on equities can increase tracking error relative to peer portfolios and standard benchmarks. Section 4.5.9 shows that the optimal hedge ratio depends on the covariance of currency returns with asset returns, interest rate differentials, and investment horizon—all of which vary over time. Therefore, a full-hedging policy means that ATP's investment results may materially differ from those of peers who leave part of their currency exposure unhedged, especially in periods when the Danish krone strengthens or weakens sharply against major currencies.

7.3.5 ATP's ESG approach

ATP's ESG approach is embedded within its broader investment framework rather than treated as a stand-alone activity. We have not been asked explicitly to assess ATP's ESG policy, which would be a substantial exercise in itself. However, as the ESG policy is part of ATP's investment beliefs and it does influence its investment strategy, we asked ATP to summarize its ESG

policy, which is presented in Section 6.1. ATP distinguishes between ESG considerations that are financially material for investment decisions and how ESG can further broaden societal materiality. Our review focuses on the role of ESG within the investment process and risk management and does not attempt to evaluate the societal consequences of ATP's investments.

ATP's ESG data and analysis are primarily concerned with identifying ESG risks and opportunities that can influence returns. ATP has a sophisticated and well-structured approach to assess ESG factors, which includes proprietary data collection on the companies that ATP invests in. The internal ESG datasets include questionnaires and data collected individually from companies, and ATP reports that this approach results in higher quality and more relevant ESG data for investment decisions compared to relying on external ESG data providers. The implementation of ESG is embedded across the organization through ESG due-diligence and monitoring, using ESG data in investment decisions and portfolio oversight, and stewardship activities.

The academic literature presents mixed evidence on the relationship between ESG and investment returns. In a comprehensive analysis, [Alves, Kruger, and van Dijk \(2025\)](#) find weak or no evidence that ESG ratings are related to stock returns. [Bruno, Esakia, and Goltz \(2022\)](#) show that ESG alphas disappear after controlling for factor exposures.⁸⁶ In a global replication study, [Eskildsen et al. \(2026b\)](#) find that realized return differences between green and brown stocks are statistically fragile, and once they account for multiple testing, there is no statistically reliable difference in realized returns. Recent equilibrium models show that when investors have positive preferences for ESG, assets with strong ESG characteristics may exhibit lower expected returns (see, for example, [Berk and van Binsbergen, 2025](#); [Pástor, Stambaugh, and Taylor, 2021](#); [Pedersen, Fitzgibbons, and Pomorski, 2021](#)). Based on such a model, [Eskildsen et al. \(2026a\)](#) combine holdings of sustainable investors with forward-looking measures of expected returns and characterize the greenium—the expected return differential between green and brown assets. They find that it is negative, varies across assets depending on their degree of being green, but is a modest part of the overall equity premium. Exclusions of sectors or companies also theoretically result in constrained investment opportunities and weakly lower returns ([Ang, Garvey, and Schwaiger, 2024](#)). We agree with ATP that the value of ESG lies in its informational content for identifying material risks and opportunities, not in the pursuit of high ESG scores per se.

ATP does not offer pensioners the option to tailor their investments according to their ESG preferences. This would be contrary to ATP's collective approach and significantly increase ATP's costs. ATP has a relatively short exclusion list. Given that ATP provides pensions to

⁸⁶Among the studies finding positive relationships between ESG and returns are [Edmans \(2011\)](#) and [Khan, Serafeim, and Yoon \(2016\)](#).

almost all Danes, it would be difficult to pursue particular and substantive exclusions based on ESG preferences. Instead, ATP pursues active engagement to try to influence companies' behavior.⁸⁷ In our view, this approach is coherent with ATP's fiduciary responsibilities and scale, allowing ESG to be incorporated through stewardship and risk management without imposing binding constraints on the investment opportunity set.

7.4 Pension sustainability

Key message

ATP's asset and liability model (ALM) indicates that the pension promise is sustainable at the current risk level—conditional on the model assumptions that ATP can de-risk if conditions deteriorate, it can maintain a minimum level of risk when there are large losses on the Bonus Potential (BP), and it can stay the course through prolonged draw-downs.

The Supervisory Board has accepted a probability of 0.6 pct over a 10-year horizon of technical insolvency (a negative BP) to support bonus capacity, the indexation ambition, and to meet other claims on the BP such as increased longevity risks.

ATP has maintained a stable bonus ratio, which is a significant achievement given market dynamics, but realized bonuses have not kept pace with inflation.

In ATP's ALM simulations, inflation indexation is achieved in 59 pct of the time over a 10-year horizon for long-run inflation averaging 2 pct and 20 pct for long-run inflation averaging 4 pct.

We evaluate ATP's pension sustainability by examining the capacity of the balance sheet to support pension delivery and bonus allocations over time, the robustness of that capacity under adverse scenarios, solvency, and the maintenance of the possibility of future bonus allocations. These are primarily asset liability management (ALM) questions, where an ALM model projects the joint stochastic evolution of assets and liabilities over long horizons. ATP's ALM model is called SAPHIR, and it produces distributions of pension outcomes, funding ratios, and solvency probabilities. In this section, we evaluate three pension outcomes: how risky is the pension one is getting? (Section 7.4.1); is there enough money to pay one's pension? (Section 7.4.2); and does one get bonus increases on top of the pension? (Section 7.4.3). Overall, we find that ATP has preserved pension sustainability over the evaluation period: the bonus ratio has been stable, and the realized risk consumption has remained within Supervisory Board

⁸⁷ Broccardo, Hart, and Zingales (2022) argue that active ownership and engagement are more effective for achieving real-world change than divestment.

limits. The chosen risk level is high and justifiable, but the strategy operates close to the upper bound of the balance sheet's risk capacity.

The use of an ALM model to examine pension outcomes is grounded in economic theory. For a pension fund, the right objective is managing the surplus of assets over liabilities or its funding ratio (Section 4.1). In liability driven investment models like ATP's, an Interest Rate Hedge Portfolio protects the liability floor and a return-seeking portfolio uses the remaining surplus or risk-bearing capital to improve future benefits. All of the elements of ATP's investments—the Interest Rate Hedge Portfolio, treasury, leverage, risk-taking architecture and Risk-seeking Portfolios, are used to implement this strategy to protect the guaranteed pensions and give upside exposure to participate in the growth of markets (Section 5.5.3). As Section 7.1 explains, these outcomes should be evaluated using pension and solvency evidence, rather than investment performance calculations.

7.4.1 Pension at risk

ATP's ALM analysis shows that the guaranteed pension is well protected on the downside, and higher investment risk mainly affects the upside potential of future bonus increases. Exhibit 7.6 reports projected real pension payments at three Investment Portfolio risk levels (20 pct risk, 40 pct risk, or maximum allowable risk) for three cohorts—members born in 1961, 1981, and 2001. The headline pattern is the same across cohorts: higher investment risk raises the median projected pension, especially for younger cohorts whose contributions still have time to compound, while the adverse scenario pension (the lower 1-percentile) is largely insensitive to the investment risk level. That is, there is a distinct asymmetry—higher levels of risk do not change the downside outcomes of the pensions very much, but there can be a large improvement in the level of pensions at high levels of risk.

The reason that high levels of risk have a muted effect on downside pension outcomes is the structural design of ATP's balance sheet combined with dynamic risk-taking. Section 6.2 shows that the Interest Rate Hedge Portfolio delivers the guaranteed cash flows whatever interest rates do, so the guaranteed pension floor is insulated from market moves. Thus, investment risk acts mostly on the bonus side of the pension rather than on the guaranteed floor. The Investment Portfolio in turn follows a Constant Proportion Portfolio Insurance (CPPI)-style dynamic risk allocation, in which risks are proportional to the size of the Bonus Potential (BP) (Section 6.4.3): when investment losses reduce the BP, the strategy de-risks, and conversely when the BP grows, risk-taking expands (See Exhibit 6.15). The combined effect at the level of an individual pension right is the hockey-stick payoff shown in Exhibit 7.7—the downside is the flat payoff (the blade) which represents the guarantee floor, the stick (shaft) represents risk sliding up and down with the size of the BP. A higher chosen risk level shifts the upside of

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this profile without materially changing the downside, which is the structural asymmetry that Exhibit 7.6 displays across cohorts. In fact, running risk “too low” is actually risky in that a beneficiary could miss out on bonus payments. Exhibit 7.6 also shows that the younger cohorts benefit more from increasing the level of investment risk, but their pension outcomes are much more uncertain than older members as their longer horizons allow both investment gains and adverse shocks to compound over time. For older cohorts, pensions in the adverse scenarios are relatively independent of the level of investment risk.

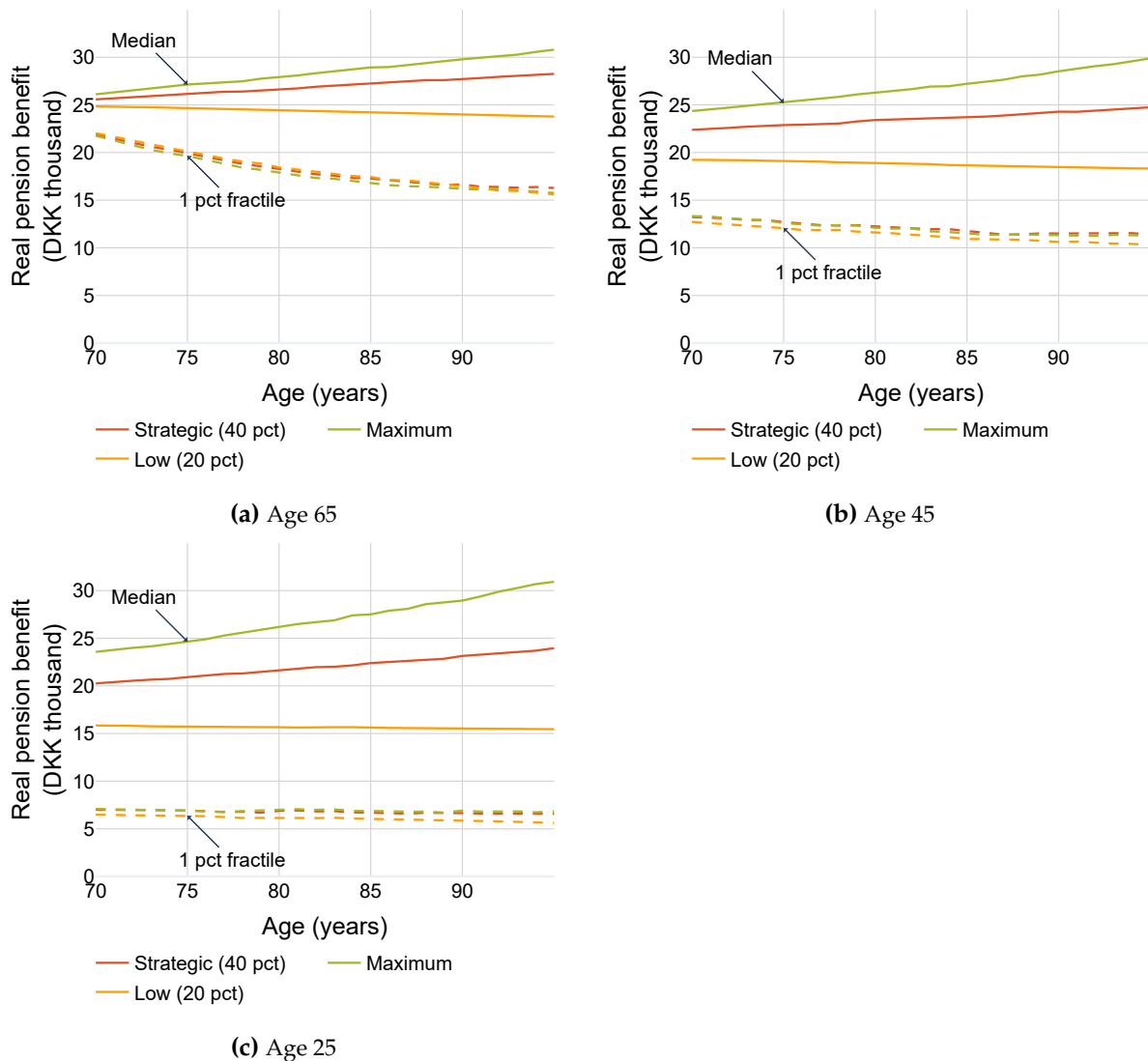
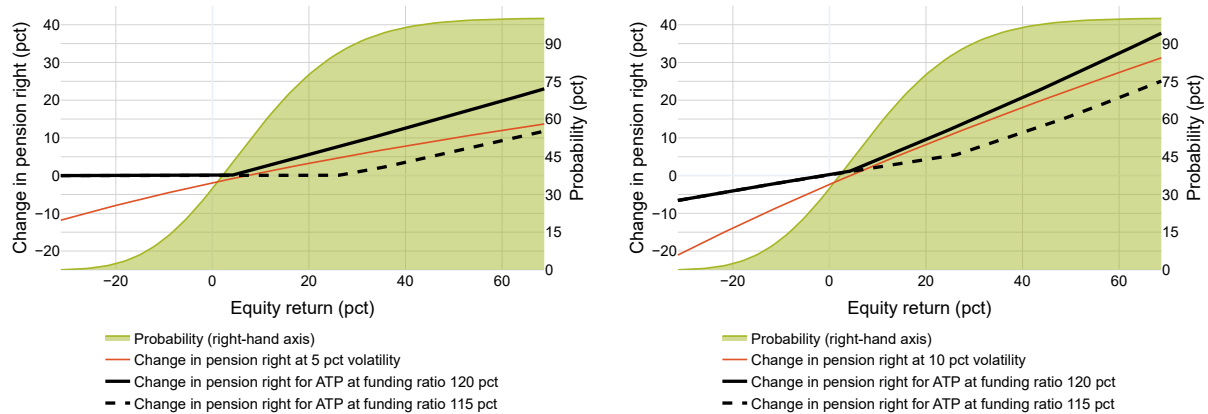


Exhibit 7.6: The impact of investment risk on pensions at median and adverse scenarios. The risk levels are low (20 pct), strategic (40 pct), and maximum. The three figures show projected annual real pension payments for three different current cohort ages, 25, 45, and 65, as a function of risk level in the Investment Portfolio. The projections take ATP's balance-sheet as of January 1, 2026, as a starting point. At every future pension age, the median and 1-percentile from the specific distribution of pension payments is reported. The figures are based on simulations from ATP's ALM model, SAPHIR, in which ATP's balance sheet, assets, life insurance portfolio, business model, investment strategy, development in member-base, financial risks and insurance risks are modelled in a “going concern” universe.

ATP's downside protection is seen not only in long-horizon ALM projections, but also in the short-term revision risk of members' pension rights, which is shown in Exhibit 7.7. The figure plots the percentage change in pension rights for ATP as a function of equity market returns, in two states: a "benign" state (initial funding ratio 120 pct, a buffer in the Supplementary Hedge Portfolio at 3 pct of guaranteed benefits) and a "harsh" state (funding ratio 115 pct, buffer at 0 pct in the Supplementary Hedge Portfolio). It also shows the change in pension rights in a market-rate product at 5 pct volatility (Panel (a)) and 10 pct volatility (Panel (b)), which are linear. Both the benign and harsh profiles show the same hockey stick pattern of Exhibit 7.7: the downside is flat because of the guarantee floor, while upside participation is preserved and damped through the bonus mechanism. The market-rate product comparisons, in contrast, participate fully in both loss and gain directions. For a person close to retirement in Panel (a), downside protection is near complete; for a person 20 years from retirement with 30 pct of pension rights in the annuity with market exposure in Panel (b), the hockey stick is more muted but still substantial.

According to the ALM models, ATP's pension is well-protected on the downside by the combination of the guarantee floor and the Interest Rate Hedge Portfolio. The principal cost of investment risk is volatility around the expected pension path—particularly for younger cohorts—rather than material erosion of the floor itself. However, the ALM model is premised on two important assumptions. First, that ATP can take timely management actions, especially reducing risk when the Bonus Potential is impaired, maintaining a minimum level of risk when the BP is low, and rebuilding buffers before distributing bonuses. Second, that ATP can continue to run the required level of investment risk through adverse markets without being forced to unwind exposures because of liquidity, collateral, or political constraints.

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(a) Close to retirement, 100 pct in guarantees, 0 pct in annuity with market exposure

(b) 20 years to retirement, 70 pct in guarantees, 30 pct in annuity with market exposure

Exhibit 7.7: The 1-year change of the pension right, given a return in the underlying equity index. In both panels: Both black lines show percentage changes in pension rights for ATP. The full line represents an initial funding ratio of 120 pct, where the Supplementary Hedge Portfolio has accumulated a 3 pct surplus as a proportion of guaranteed benefits. The dashed line represents an initial funding ratio of 115 pct, where the Supplementary Hedge Portfolio has accumulated a zero pct surplus as a proportion of the guaranteed benefits. The orange lines represent percentage changes in pension rights in a low-risk market rate product. The green area is the cumulative distribution function for equities (log-normal at 15 pct volatility), whose values are depicted on the right-hand axis. It is assumed that equity markets are the sole risk factor and that Bonus Potential in excess of a bonus ratio of 20 pct is paid out as bonus.

Panel (a) approximates a “close to retirement case,” where the entire ATP pension right is made up entirely of guaranteed benefits and the market risk product is invested at 5 pct volatility.

Panel (b) approximates a “20 years to retirement case,” where the entire ATP pension right is made up of 70 pct guaranteed benefits and 30 pct in annuity with market exposure, while the market risk product is invested at 10 pct volatility.

7.4.2 Solvency

ATP can become technically insolvent in the ALM sense, which is defined when the Bonus Potential (BP), which absorbs investment losses before the guarantee, turns negative. This is a different event from an inability to pay current pensions. The guarantee floor is protected first, and the modelled recovery rates in the insolvency scenarios remain high. Exhibit 7.8 enumerates the probability of becoming technically insolvent, or equivalently of a negative Bonus Potential.

Exhibit 7.8: Overview of insolvency events: probabilities, expected recoveries, and losses. The table shows various metrics in the case of negative Bonus Potential (technical insolvency). The investment risk levels are: Low = 20 pct of BP, Target = 40 pct of BP, and Max = maximum risk budget. "Recovery orderly fashion" is the market value of all assets divided by the market value of liabilities discounted at the risk-free rate. "Recovery distressed fashion" is the same as orderly fashion but with a haircut of 20 pct on all illiquid assets. Finally, the expected annual loss rate is the probability of insolvency multiplied by one minus the expected recovery, divided by the horizon (Expected annual loss rate = Probability of insolvency $\times$ (1 – expected recovery)/Horizon).

Investment risk level		5-year horizon			10-year horizon		
		Low	Target	Max	Low	Target	Max
Probability (pct)		0.0	0.1	0.3	0.1	0.6	1.5
Expected recovery (pct)	Orderly fashion	94.1	93.5	93.7	93.5	93.8	94.2
	Distressed fashion	91.8	91.0	91.3	91.1	91.3	91.7
Expected annual loss rate (pct)	Orderly fashion	0.00	0.00	0.00	0.00	0.00	0.01
	Distressed fashion	0.00	0.00	0.01	0.00	0.01	0.01

At ATP's current strategic risk target—ES(99 pct, 3M) at 40 pct of the Bonus Potential, which is roughly 30 pct annual volatility on the Investment Portfolio—ATP's modelled probability of technical insolvency (a negative Bonus Potential) is 0.1 pct over a five-year horizon and 0.6 pct over a 10-year horizon(Exhibit 7.8). These probabilities are low but not zero. It is worthwhile to contrast these positive probabilities of negative BP with the pension payment insensitivity in Section 7.4.1: while adverse scenario pension payments are largely insensitive to the level of investment risk, the level of risk-taking does affect insolvency probabilities. The relationship is convex: at the "low" benchmark (20 pct $\times$ BP) the 10-year probability of technical insolvency is 0.1 pct, rising to 0.6 pct at the 40 pct-of-BP target, and to 1.5 pct at the Supervisory Board maximum risk budget. Recovery rates in the insolvency scenarios are in the 91–94 pct range across risk levels, depending on whether illiquid assets are valued at orderly or distressed levels.

The Supervisory Board has chosen a risk appetite with a probability of 0.6 pct technical insolvency over a 10-year horizon. The choice reflects a deliberate trade-off. A lower risk level would reduce the probability of negative BP, but it would also reduce the expected return needed to, among other things, sustain bonus capacity. A higher risk level increases the possibility of future bonus allocations and supports the indexation ambition, but it also raises the probability that the BP is depleted in adverse states. ATP's selected risk target is best understood as the Supervisory Board choosing to balance between small probabilities of technical insolvency and taking enough risk in the new business model, which allows, among other things, the payment of future bonuses.

Solvency II analysis

Although ATP is not under Solvency II, and we do not recommend that it should be, a Solvency II-style proxy provides a useful external reference point for interpreting ATP's risk tolerance, and it shows that the Supervisory Board's risk limits are high compared to the risks other funds take. Exhibit 7.9 reports Solvency II-style capital ratios across Investment Portfolio risk targets, holding longevity risk as a constant share of guaranteed benefits, and operational and counterparty risk as constant shares of AuM. (Longevity risk is the largest non-market risk.) The table shows various Solvency II-style metrics with varying degrees of Investment Portfolio risk measured in ATP's ES(99 pct, 3M) metric. As usual in Solvency II calculations, this does not take into account management actions. In Panel (a), where the risk in the Supplementary Hedge Portfolio can be absorbed within the Long-term Supplementary Reserve and does not materially affect the Bonus Potential, the current 40 pct Investment Portfolio target uses 69 pct of the Supervisory Board's maximum risk tolerance and produces a Solvency II capital ratio proxy of 149 pct. However, if ATP used the Board's entire risk budget, the Solvency II capital proxy would barely be above 100. Other pension funds in Denmark stay well above this level (Section 4.6.2).

The same Solvency II proxy shows that ATP's solvency margin narrows sharply when the balance sheet is under stress. Panel (b) assumes a funding ratio of 110 pct and that the Long-term Supplementary Reserve is reduced to one quarter of its current size, so that roughly half of the risk in the Supplementary Hedge Portfolio affects the Bonus Potential in adverse scenarios. In Panel (b), the same 40 pct $\times$ BP risk target implies a Solvency II coverage ratio of 116 pct, which is 89 pct of the Board maximum, with the Board's maximum tolerance binding well before the 60 pct-of-BP target is reached. Under this stressed configuration, the current 40 pct Investment Portfolio target uses 89 pct of the Supervisory Board's maximum risk tolerance. This produces a Solvency II capital ratio proxy of 116 pct. In this scenario, ATP remains solvent at the current target, but the margin to the Board limit is much smaller. These results are consistent with the construction of the Supplementary Hedge Portfolio (Section 5.5.4) and the hockey-stick dynamic risk (Section 6.6).

Exhibit 7.9: Approximate Solvency II capital ratios for different risk targets. ATP is not under Solvency II regulation. However, the table calculates a hypothetical approximative Solvency II capital ratio as a function of an applied risk level in the Investment Portfolio. Panel (a) approximates ATP's current situation, while Panel (b) assumes a situation where ATP is under a stressed scenario, where severe losses have been realized and the funding ratio has dropped to 110 pct. The calculations include capital requirements for longevity risk as a constant share of Guaranteed Benefits, operational as well as counterparty risk as a constant share of AuM. The calculations use ATP's internal risk model, not the Solvency II standard model.

ES(99 pct, 3M) risk in Investment Portfolio	60 pct	50 pct	40 pct	30 pct	20 pct
Volatility in Investment Portfolio	45 pct	38 pct	30 pct	23 pct	15 pct
Panel (a): Funding ratio = 120 pct					
Risks After market risk and longevity (pct)	51	43	35	26	18
Risk consumption (pct of Supervisory Board maximum)	103*	86	69	53	37
Solvency II approximative capital ratio (pct)	101	120	149	195	280
Probability of technical insolvency (pct)	0.48	0.10	0.01	0.00	0.00
Panel (b): Funding ratio = 110 pct, LSH drops 1/4 in size					
Risks After market risk and longevity (pct)	61	53	45	37	29
Risk consumption (pct of Supervisory Board maximum)	122*	105*	89	73	58
Solvency II approximate capital ratio (pct)	85	98	116	141	178
Probability of technical insolvency (pct)	1.44	0.58	0.14	0.01	0.00

* When risk consumption is more than the risk tolerance set by the Supervisory Board, the strategy is infeasible since the risk floor, which keeps risk at a minimum absolute level, is not activated before the Funding Ratio is below 110 pct. These strategies are included for completeness.

There are several differences between the first solvency analysis and the Solvency II analysis, but history suggests that one should be careful in assuming that the future will be as benign as the models assume. The major difference between the two calculations is that in the first calculation it is assumed that management can act and reduce risks as the world deteriorates. The Solvency II calculation assumes that ATP is hit by an instantaneous shock and that management action is not possible. The Global Financial Crisis (2007–2009) was not kind to risk modelling. Events that should not happen in a thousand years suddenly happened with high frequency. One problem was that risk models were based on an extrapolation of historical data distributions. Therefore, care should be exercised in taking risk model predictions too literally. Buffers are generally advisable.

7.4.3 Bonus ratio

ATP has sustained its capacity to grant bonus increases—the bonus ratio has been broadly stable through the evaluation period and substantially more stable than under any counter-

factual reference portfolio. Bonus ratio is the forward-looking capacity to grant bonuses, or equivalently the ratio of the Bonus Potential to pension liabilities (also equal to the funding ratio minus one, see Section 4.1.1). Exhibit 7.10 plots ATP's realized bonus ratio from 2002 to 2024 against counterfactual paths under global equities, global bonds, and a 60-40 equity-bond portfolio, holding contributions, benefits paid, and the bonus-allocation strategy fixed. Under all the counterfactual benchmarks, the bonus ratio would have deteriorated during and after the Global Financial Crisis in 2008. (This is also the pattern for some international pension plans, as Section 4.6 reports.) The all-equity counterfactual would have only reached zero pct bonus ratio in 2021. It is a marked contrast that ATP maintained its Bonus Potential around 20 pct for the whole period. This was possible during the Global Financial Crisis largely because the Interest Rate Hedge Portfolio increased in value as interest rates fell, offsetting the corresponding increase in the value of ATP's guaranteed liabilities, while diversification cushioned the losses on equities. The counterfactual portfolios do not replicate this liability hedge and are much more exposed to the combination of falling equity markets and changing liability values.

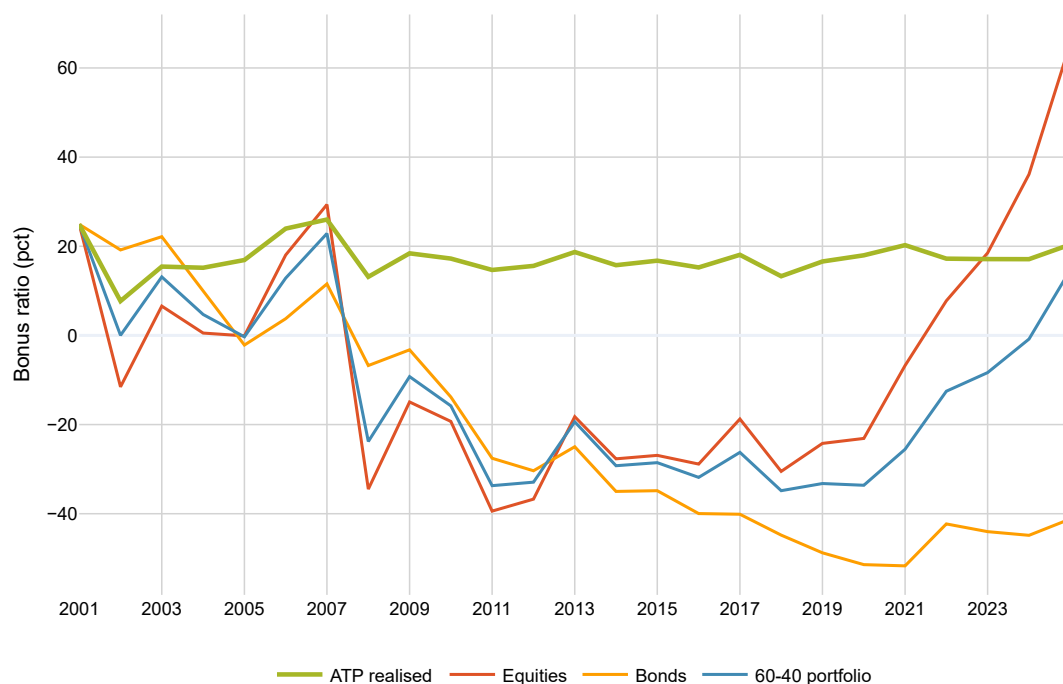


Exhibit 7.10: Historical bonus ratio of ATP. The figure graphs the historical development in ATP's bonus ratio starting from 2002 to 2024 along with how bonus ratio would have evolved if the returns would have followed other hypothetical portfolios: Global equities (MSCI ACWI, currency hedged), global bonds (Bloomberg Global Treasury Index, currency hedged) and a 60-40 portfolio of those. In the hypothetical calculations, everything else is assumed equal, including contributions received, benefits paid, and bonus strategy.

The ability to pay bonuses (high Bonus Potentials) is not the same as having paid bonuses. Section 5.4.5 highlighted that ATP's realized bonus distributions have not kept pace with realized

inflation. Exhibit 5.10 shows that over 2002 to 2025, cumulative inflation indexation required to preserve real value totaled approximately 36 pct, while actual bonus distributions to old-age pensioners were approximately 18 pct without the write-up due to increased longevity and 30 pct including increased longevity. Individuals who were not old-age pensioners experienced indexation of 9 pct not including increased longevity and 20 pct including increased longevity. This is not surprising given Sections 6.4 and 6.5, which show that indexing pensions to realized inflation on top of the nominal guarantee (which includes expected inflation) is an ambitious objective. Thus, while ATP's bonus ratio has been sustainable, which itself is a notable achievement as Exhibit 7.10 shows relative to other benchmark portfolios, maintaining the bonus ratio did not translate into meeting the inflation ambition.

7.4.4 Inflation indexation

According to ATP's ALM simulations when long-run inflation is 2 pct, the inflation indexation objective is achievable in the majority, but far from all, future states. The relevant question is not whether ATP can hedge realized inflation perfectly; it cannot, and the ATP product does not promise full inflation indexation (Sections 5.4 and 6.4). The question is whether the current investment strategy generates enough bonus capacity over time to preserve the real value of guaranteed pensions with reasonable probability while still protecting solvency. Exhibit 7.11 evaluates this trade-off over a 10-year horizon by measuring how much of realized inflation is compensated through accumulated bonuses under different risk levels (Low = 20 pct $\times$ BP; Target = 40 pct $\times$ BP; Max = 60 pct $\times$ BP). A ratio of 100 pct means that the real value of the guaranteed pensions has been exactly preserved via the allocated bonuses.

At the target level of risk, ATP is more likely to preserve the real value of guaranteed pensions than not, but far from assured, at 59 pct and in the median outcome, guaranteed pensions are indexed with 117 pct of inflation. Exhibit 7.11 also reports the probability of obtaining a non-negative real bonus (the probability of being able to fully index guarantees with inflation) as well as the average inflation compensation. If the real bonus cannot be achieved, it reports the percentage average inflation compensation in the event of a negative real bonus. In the 41 pct of outcomes where the guarantees are not fully indexed with inflation, ATP's members can expect to be compensated with around 57 pct of realized inflation. In these scenarios where ATP cannot fully index pensions, the members can expect to get partial and moderate inflation compensation.

Exhibit 7.11: Overview of inflation compensation on a 10-year horizon. The table shows various measures for inflation compensation as a function of risk level in the Investment Portfolio. The inflation compensation ratio is measured as the ratio between accumulated bonuses divided by accumulated inflation at the end of the horizon considered. A compensation of 100 pct means that the accumulated bonus exactly matches the realized inflation corresponding to preserving the real purchasing power of the nominal guarantees and to a real bonus of zero.

Long run inflation regime	2 pct			4 pct		
	Low	Target	Max	Low	Target	Max
Investment risk level*						
Median inflation compensation ratio (pct)	85	117	135	46	64	75
Average inflation compensation ratio (pct)	98	133	158	50	69	81
Probability real bonus > 0** (pct)	39	59	65	4	20	32
Avg. inflation comp. ratio, given real bonus ≤ 0*** (pct)	60	57	52	46	54	53

* Investment risk level: Low = 20 pct × BP; Target = 40 pct × BP; Max = 60 pct × BP.

** A real bonus of zero corresponds to an accumulated bonus exactly equal to accumulated inflation

*** Conditional average. The average of all simulated compensations, given that compensation is less than 100 pct

Higher levels of risk raise the inflation compensation because higher risk raises expected returns. In Exhibit 7.11, the median compensation ratio rises from 85 pct at the low risk level to 117 pct at the target risk level and 135 pct at the maximum risk. The probability of full inflation compensation also rises. The trade-off is that higher risk worsens the downside in the states where full indexation is not achieved; conditional on failing to fully compensate for inflation, the average compensation ratio falls from 60 pct at the low risk level to 57 pct at target risk and 52 pct at the maximum risk. Thus, the current target captures much of the gain from taking investment risk, while avoiding the larger deterioration in downside inflation compensation that appears at the maximum risk level.

At a long-run inflation rate of 4 pct, the probability of preserving the real value of guaranteed pensions is 20 pct, reported in Panel (b) of Exhibit 7.11. This is much lower than the 59 pct of cases than when inflation is 2 pct—the large decrease is because the indexation hurdle rises much faster than the balance sheet's expected bonus capacity. A 2 pct inflation rate increases the price level by about 22 pct over 10 years, while 4 pct inflation increases it by about 48 pct; the required accumulated bonus is therefore approximately twice as large. Historical inflation over the last four decades has been low, which is referred to as the Great Moderation when inflation and macroeconomic volatility were unusually subdued (McConnell and Perez-Quiros, 2000; Stock and Watson, 2002). However, inflation over the 1970s and 1980s approached 20 pct so higher inflation regimes cannot be dismissed. Since Covid in 2020, inflation has increased due to supply constraints, sectoral price shocks, and commodity price increases, raising the question of whether the Great Moderation low inflation regime will persist (Ball, Leigh, and

Mishra, 2022; Bernanke and Blanchard, 2025; Pflueger, 2025).

7.5 Balance sheet dynamics

Key message

The headline geometric return on ATP's total wealth of 5.6 pct per year over 2002 to 2025 matches the 5.6 pct return of a 60-40 equity-bond portfolio over the same horizon. From 2015 to 2025, the Risk-seeking Portfolios alone have a Sharpe ratio of 0.75, slightly above the 0.68 of a 60-40 portfolio. The Interest Rate Hedge Portfolio and Treasury Portfolio, the majority of ATP's balance sheet, delivered a negative return over the period, reflecting the offsetting decline in guaranteed pensions as interest rates rose.

ATP's investment risk has moved through four regimes since 2009—very high before 2011, low from 2011 to 2018, moderate from 2018 to 2023, and high again under the new business model from 2023—but total balance sheet risk has held broadly stable at around 12 pct annualized volatility on AuM since 2014. The low risk taken from 2011 to 2018 was costly, coinciding with strong returns on risky assets in which ATP participated less than it otherwise would have. Total risk has remained stable because the Interest Rate Hedge Portfolio stays the dominant balance sheet risk, even as investment risk on AuM rose from roughly 3 pct to 7.5 pct.

Leverage reached its highest level in 2025 under the new business model, rising from 2017 to 2021, falling sharply in the 2022 rate shock, then climbing to its peak in 2025. Throughout, unencumbered cash stayed above 10 pct of the balance sheet, indicating that rising leverage was accompanied by adequate liquidity.

7.5.1 Long-run wealth accumulation

Balance sheet growth is an easy and intuitive metric for evaluating a pension fund, but it must be interpreted with care as it is not a direct measure of whether ATP's pension promise has been kept. For ATP, the total wealth (AuM) on the balance sheet comprises the Interest Rate Hedge Portfolio, the Risk-seeking Portfolios, and the cumulative effects of contributions, benefits paid, bonus allocations, longevity write-ups, and balance sheet revaluations driven by interest rate movements. We reiterate that the most important measure of success is whether ATP has delivered on its pension promise, which we discuss in Section 7.4. But AuM growth does matter because in the long run, the asset growth is the ultimate source from which pensions are paid; a pension fund with rising real assets has more capacity to absorb adverse shocks and to support future bonus allocations than one whose assets are static or shrinking. This total wealth

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view should therefore be read not as a direct performance measure but as an indicator of ATP's capacity to maintain the pension guarantee and provide inflation adjustments.

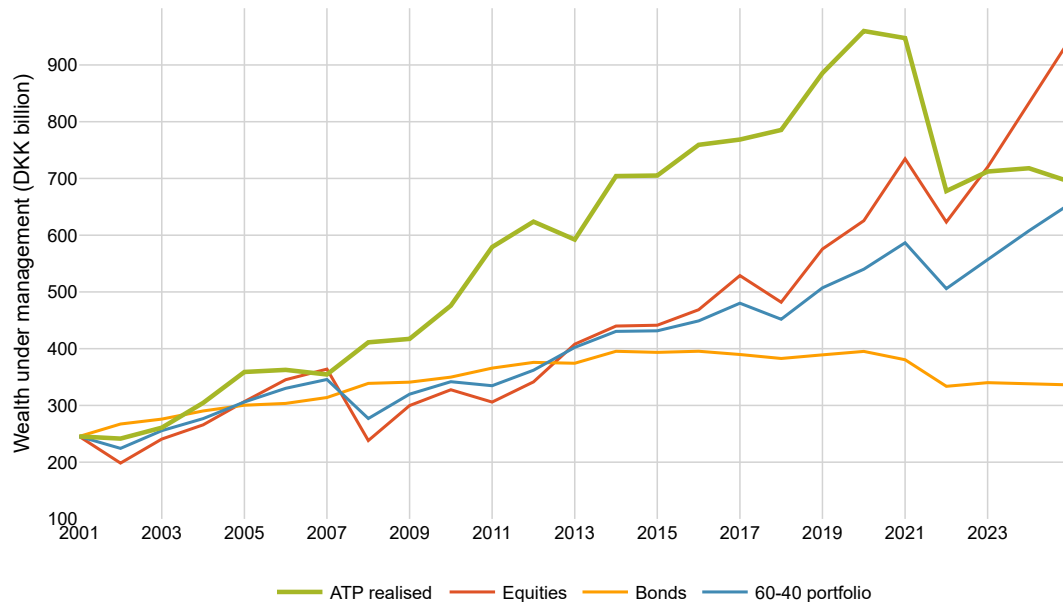


Exhibit 7.12: Wealth accumulation in ATP since 2001. The figure depicts the development in ATP's total wealth (AuM) starting on December 31, 2001, ending on December 31, 2025. The financial year, 2002, is the first year, where all items in the balance sheet were valued at market value and taxation was harmonized across all asset categories. The figure also shows how total wealth would have evolved under the hypothetical scenarios, where the return followed selected benchmarks: Global equities (MSCI ACWI, currency hedged), global bonds (Bloomberg Global Treasury Index, currency hedged) and a 60-40 portfolio. In the hypothetical calculation everything else is assumed equal, including contributions received, benefits paid, and bonus strategy.

From 2001 to 2025, ATP's total wealth grew from DKK 245 billion to DKK 694 billion while a 60-40 equity-bond portfolio would have grown the balance-sheet to a smaller value of DKK 656 billion over the same horizon. This follows from Exhibit 7.12, which reports the path of total AuM alongside hypothetical paths in which ATP's investment returns would have followed the MSCI ACWI (currency-hedged), the Bloomberg Global Treasury Index (currency-hedged), and a 60-40 portfolio mix of the two, with contributions, benefits, and bonus strategy held fixed. The evaluation period starts in 2002 because it is the first financial year in which all balance sheet items were marked to market and the tax harmonized across asset categories. It is also seen that ATP's accumulated wealth is less than what would have been obtained by a MSCI ACWI portfolio (DKK 946 billion), but substantially more than the wealth hypothetically obtained by the bond portfolio (DKK 336 billion), dispelling the notion that ATP is merely a bond investor.

The returns on ATP's AuM and Risk-seeking Portfolios vary substantially over time. Exhibit 7.12 shows total returns of the two portfolios as well as their excess returns over the 60-40 equity-bond portfolio. It is seen that from 2001 to 2025, the annual geometric investment

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return on AuM and the 60-40 portfolio were equal at 5.6 pct. Over the same period, ATP's Risk-seeking Portfolios outperformed the 60-40 reference by 4.7 pct per year. From 2015 to 2025 average annual return on all assets under management and the Risk-seeking Portfolios were 0.8 pct and 12.1 pct per year compared to 6 pct per year for a 60-40 portfolio. Below, the period from 2015–2025 will be discussed further. In the period from 2022 onwards both AuM and the Risk-seeking Portfolios underperformed the 60-40 portfolio with returns of –5.8 pct and –7.7 pct, respectively, compared to 4.5 pct in the 60-40 portfolio.

Exhibit 7.13: Returns on selected portfolios and horizons. The table shows annualized geometric total returns on ATP's Risk-seeking Portfolios, AuM and the 60-40 reference portfolio over four different periods, all ending December 31, 2025. Excess returns on ATP's Risk-seeking Portfolios versus the 60-40 portfolio are also reported. The starting date is December 31 in the year preceding the year given in the table. All figures are in pct.

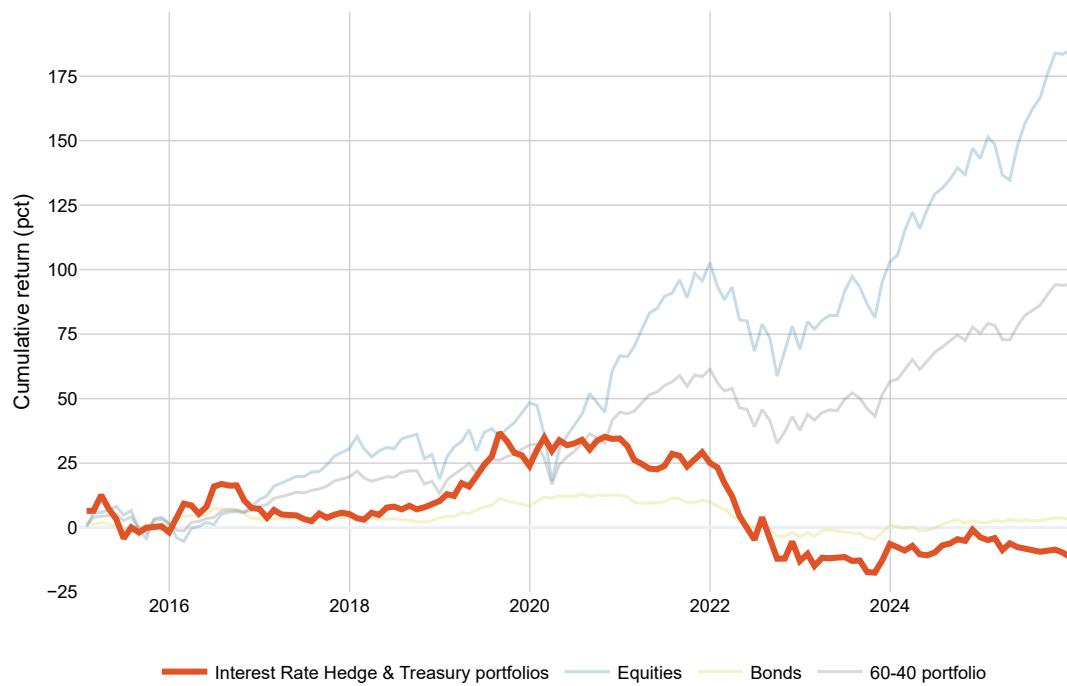
Start year	Total			Excess versus 60-40	
	Risk-seeking portfolios	AuM	60-40	Risk-seeking portfolios	AuM
2002	10.3	5.6	5.6	4.7	0.0
2015	12.1	0.8	6.0	6.0	–5.2
2020	5.1	–3.7	6.4	–1.3	–10.1
2022	–5.8	–7.7	4.5	–10.3	–12.2

The Interest Rate Hedge Portfolio and the Treasury Portfolio experienced negative returns over 2015 to 2025, while the Risk-seeking Portfolios experienced positive returns. Exhibit 7.14 decomposes the accumulated return on total AuM in Panel (a), the Interest Rate Hedge Portfolio and Treasury Portfolio in Panel (b) and the Risk-seeking Portfolios since 2015 in Panel (c). Assets under management grew at a similar rate to a 60-40 portfolio until 2020 and then diverged in 2022. Since that time there have been large deviations from 60-40. In 2022, the ATP portfolio drew down more than 60-40 because of the reduction of the value of the Interest Rate Hedge Portfolio in Panel (b) due to rising interest rates—and the Interest Rate Hedge Portfolio is the dominant item on ATP's balance sheet. (We detail the performance of the Interest Rate Hedge Portfolio in Section 7.6.2.) The Interest Rate Hedge Portfolio and the Treasury Portfolio have a return of –1.1 pct per annum over the period.

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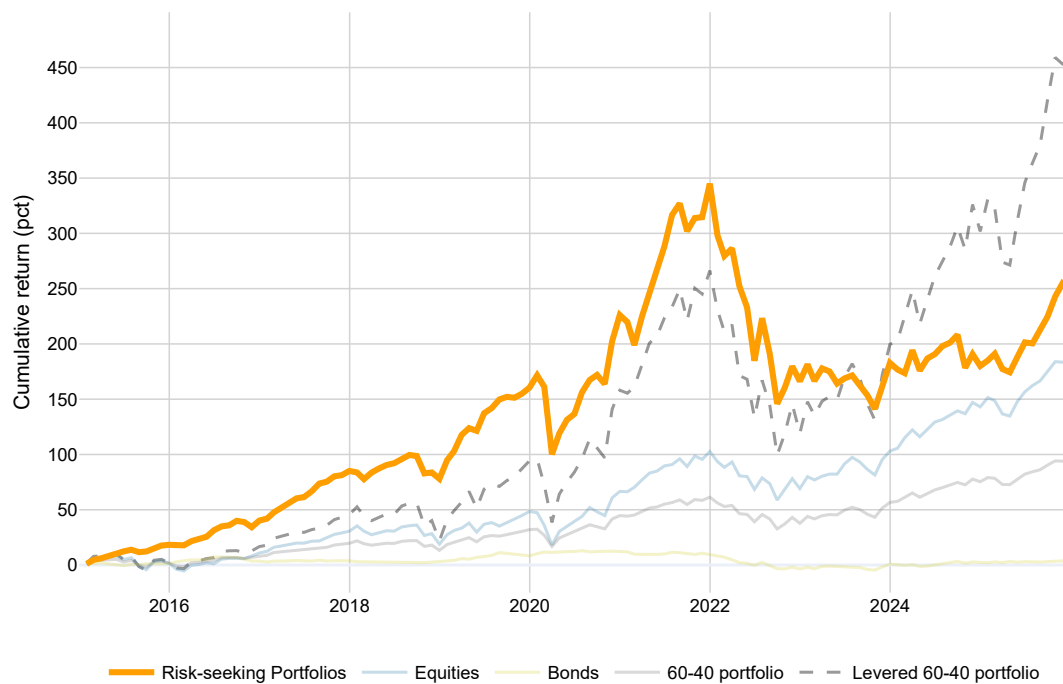


(a) Assets under management



(b) Interest Rate Hedge Portfolio and Treasury Portfolio

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(c) Risk-seeking Portfolios

Exhibit 7.14: Wealth accumulation in ATP portfolios. Panel (a) shows the cumulative return on AuM; Panel (b) shows the cumulative return on the Interest Rate Hedge Portfolio and the Treasury Portfolio; Panel (c) shows the cumulative return on the Risk-seeking Portfolios. For comparison, the cumulative returns on the three main benchmarks are also shown: all-equity, all-bond, and a 60-40 portfolio. Panel (c) also shows the 60-40 portfolio levered to the same ex-ante risk level as ATP.

Over 2015 to 2025, the Risk-seeking Portfolios performed well, delivering a higher return than an all-equity portfolio and beating the 60-40 portfolio, as shown in Panel (c) of Exhibit 7.14. This is a meaningful comparison because the 60-40 portfolio is a simple, low-cost, and widely used reference portfolio for institutional investors, and the 60-40 portfolio is hard to beat over long horizons (Barber and Wang, 2013; Ennis, 2020). The figure also shows a 60-40 portfolio levered to the same ex-ante volatility as the Risk-seeking Portfolios. ATP's Risk-seeking Portfolios outperformed the levered 60-40 portfolio up until 2022, when they suffered a larger drawdown than the levered 60-40 due to its higher fixed income exposure (Section 6.3.4). Since 2022, the levered 60-40 has outperformed ATP because ATP is underweight the US, which has exhibited very strong performance, and bonds have had relatively low returns.

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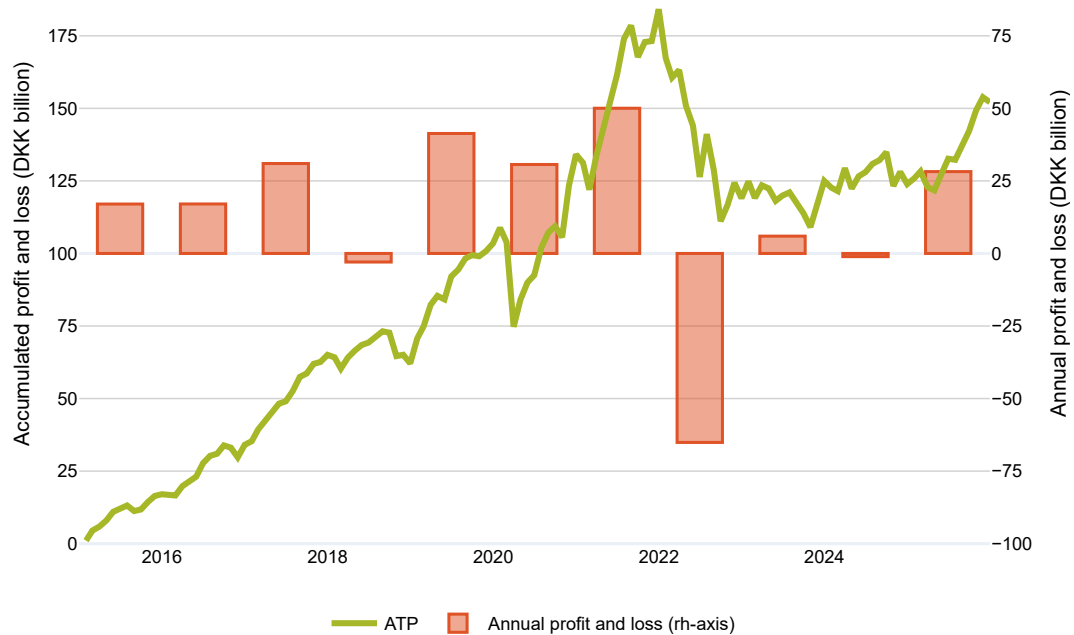


Exhibit 7.15: Annual profit and loss of ATP.

On a volatility-adjusted basis the Risk-seeking Portfolios has performed broadly in line with the equity and levered 60-40 benchmarks, and its realized Sharpe ratio of 0.75 is slightly above the levered 60-40 benchmark of 0.68. Exhibit 7.16 reports the same series as Exhibit 7.14 after scaling each portfolio's ex-ante volatility to 10 pct using ATP's internal risk model. The Interest Rate Hedge Portfolio and Treasury Portfolio track the bond benchmark closely. Although having a higher Sharpe ratio than 60-40, the Risk-seeking portfolio has underperformed the 60-40 portfolio from 2022 with both series scaled to 10 pct ex-ante volatility.

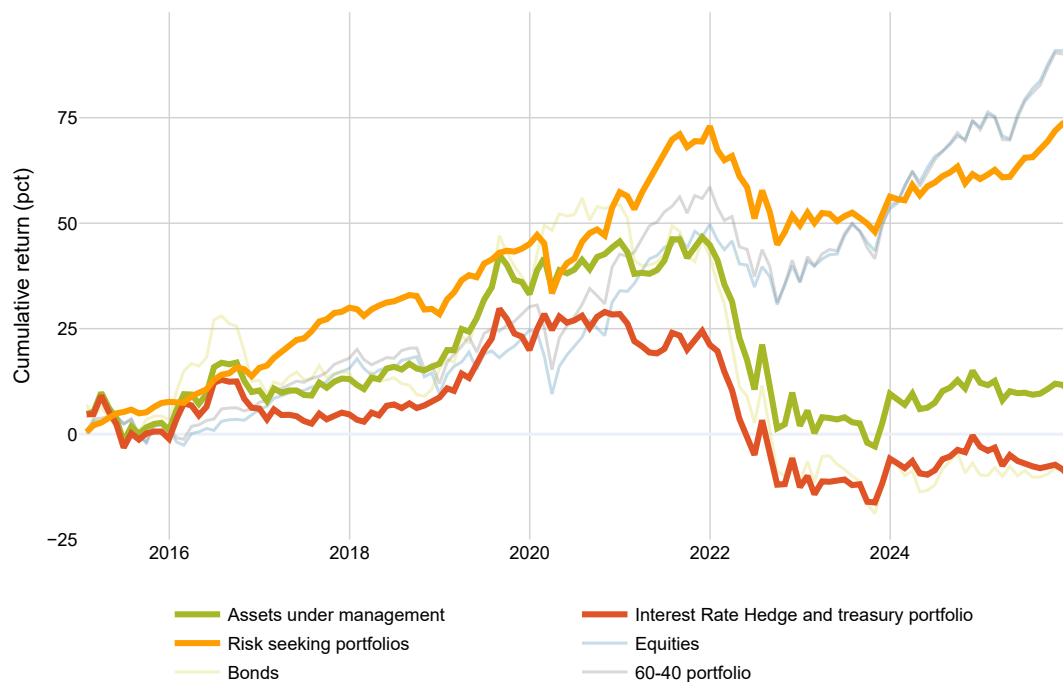


Exhibit 7.16: Wealth accumulation in ATP portfolios adjusting to 10 pct volatility. The figure shows the cumulative return on the AuM as well as on the two sub-portfolios, the Interest Rate Hedge Portfolio and Treasury Portfolio combined and the Risk-seeking Portfolios. For comparison, the cumulative return on the three main benchmarks are also shown: all-equity, all-bond, and 60-40. All returns are calculated after adjusting the respective portfolio's risk to 10 pct ex-ante annual volatility.

7.5.2 Risk exposures

Taking investment risk is an explicit aim of ATP's investment strategy, and ATP has generally successfully achieved its targeted risk levels except over 2012 to 2018 when risk-taking was low. Section 6.4 shows that ATP's required returns are high because the indexation ambition must be met through a relatively small risk-bearing buffer. Sections 6.5 and 7.4 also explain that the chosen risk level is also set through ALM analysis balancing expected pension indexation with downside pension risk. Exhibit 7.17 reports risk consumption on the Risk-seeking Portfolios and on the Investment Portfolio relative to unguaranteed funds and Bonus Potential, together with the volatility of unguaranteed funds induced by the Risk-seeking Portfolios. The target risk level is 40 pct ES(99 pct, 3M), and the units on the y-axis are in terms of this risk measure.

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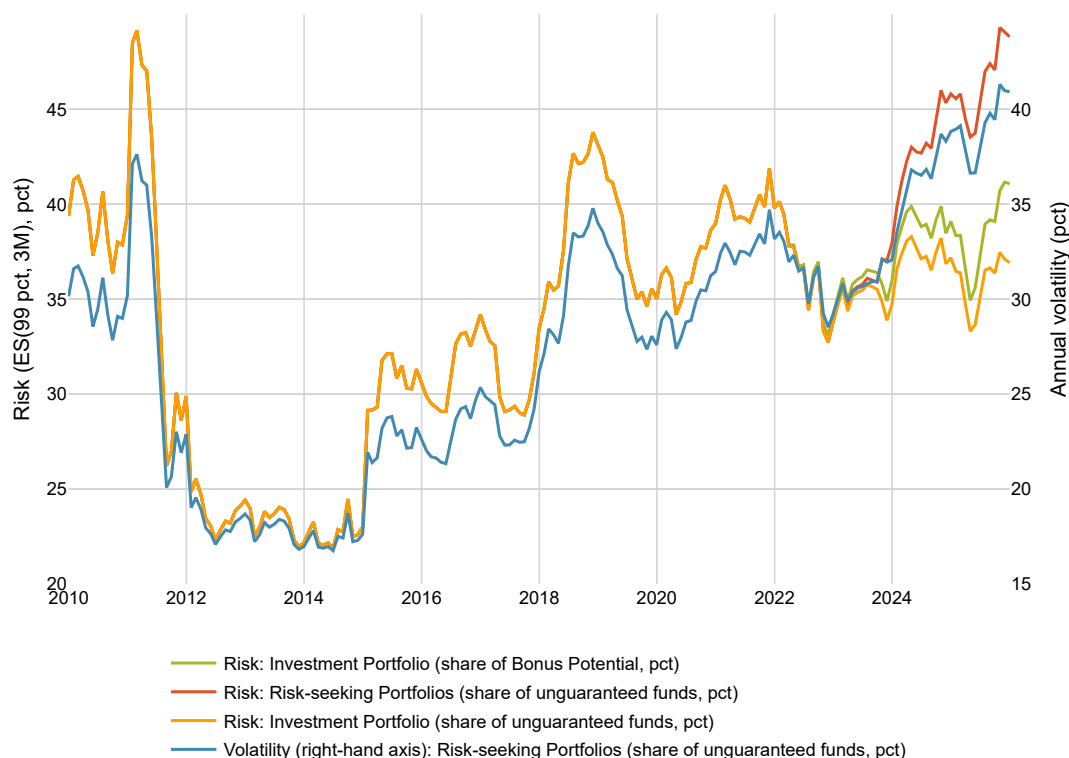


Exhibit 7.17: ATP's historical risk consumption expressed in a risk capacity view. The left-hand side depicts historical risk consumption of the Risk-seeking Portfolios and the Investment Portfolio relative to unguaranteed funds and Bonus Potential. Risk is expressed in terms of Expected Shortfall, ES(99 pct, 3M). The ratios coincide until January 2023, while afterwards they differ due to the introduction of the Supplementary Hedge Portfolio and the Market Return Portfolio. The right-hand side shows the volatility of the unguaranteed funds induced by its Risk-seeking Portfolios. Between December 31, 2009, and January 17, 2017, the reported total asset risk is approximative, since official correlation data between the Risk-seeking Portfolios and the Interest Rate Hedge Portfolio have not been stored. The correlations from this period have been backfilled. On December 21, 2011, a model revision reduced calculated risk on Infrastructure and Real estate.

There are four distinct periods of risk-taking over ATP's history from 2009 to 2025. Period 1 (2009 to 2011) saw very high risk utilization, close to 100 pct of the stated risk target. Period 2 (2011 to 2018) saw a sharp cut in risk utilization. Following a drop in the bonus ratio, risk utilization was taken down to roughly 50 pct of the target, with the ES on the Investment Portfolio falling from a 40 pct to 50 pct range of the Bonus Potential to a 20 to 30 pct range. Period 3 (2018 to 2023) was a regime shift back to a 30 to 40 pct range of the Bonus Potential. This lasted until period 4 (2023 onward) when the new business model was introduced. In this regime, the Risk-seeking Portfolios (INV plus M plus SAP) has reached approximately 48 pct of unguaranteed funds,⁸⁸ with the volatility of Unguaranteed funds induced by the Risk-seeking Portfolios at approximately 40 pct. We comment further on the new business model in Section 7.7.6.

⁸⁸Unguaranteed funds equals the Bonus Potential plus H_m (the reserve matching the market value of the Market Return Portfolio) and the surplus (returns from the Supplementary Hedge Portfolio) not yet transferred out of LSH to the Bonus Potential. Unguaranteed funds represents every item on the liability side which has loss absorbing capacity.

On a total balance sheet view, the risk taken on the total asset-side has been broadly stable at around 12 pct annualized volatility on AuM since 2014, even as Investment Portfolio risk on AuM rose from approximately 3 pct to approximately 7.5 pct. Exhibit 7.18 reports the expected-shortfall risk on the Risk-seeking Portfolios and on the total asset portfolio relative to AuM, together with the equivalent annualized volatility on AuM. From 2010 to 2014 total asset side risk fell from approximately 16 pct to approximately 12 pct, which was partly due to the previously mentioned decision to cut risk and partly due to the year-end 2013 change in the discounting curve that reduced the duration required to hedge guaranteed benefits. Since 2014 total asset side risk has been stable at approximately 12 pct. Over the same period, risk in the Risk-seeking Portfolios relative to AuM has risen from approximately 3 pct in the low-risk period to approximately 7.5 pct in today. The Interest Rate Hedge Portfolio remains the dominant balance sheet risk consumer, but the Risk-seeking Portfolios now accounts for a materially larger share of total asset risk than it did in 2011 to 2018 when risk was low.

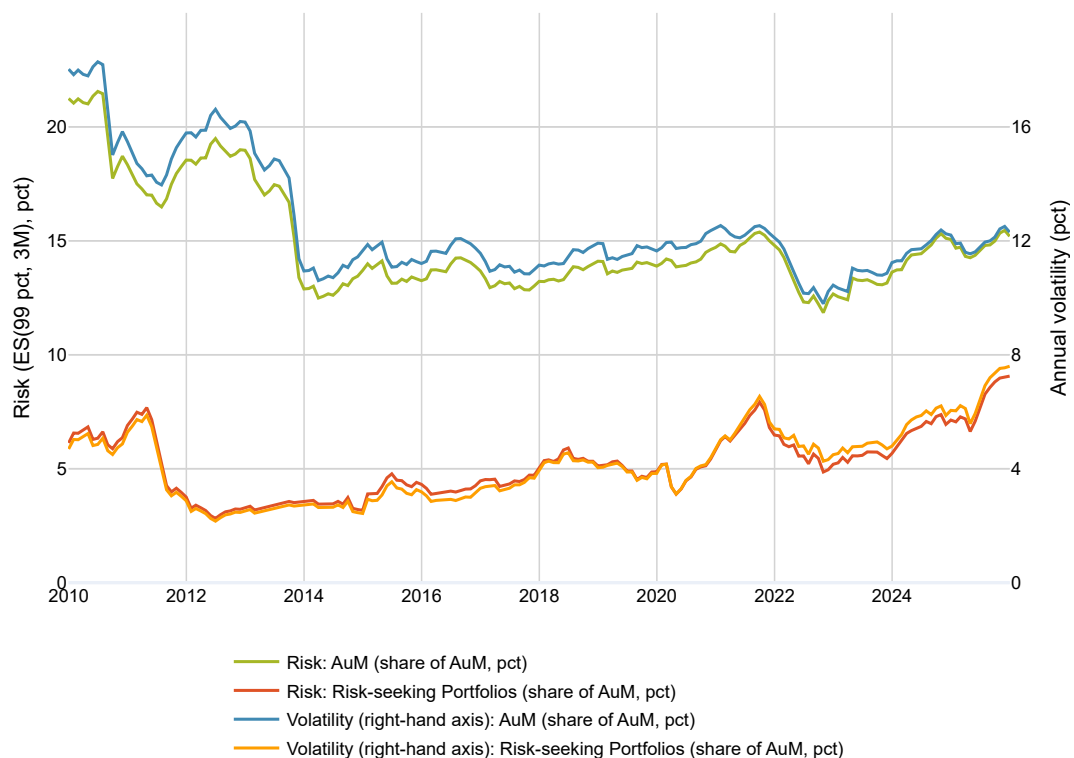


Exhibit 7.18: ATP's historical risk consumption expressed in a total balance sheet view. The left-hand side expresses the Expected Shortfall risk on the Risk-seeking Portfolios and the total asset portfolio relative to AuM. The right-hand side expresses the equivalent volatility induced by the portfolios on AuM.

The choice to run low investment risk during 2011 to 2018, a period of strong risky asset returns, has lowered cumulative returns relative to a counterfactual in which risk had been held at the post-2018 level. The average volatility of the Risk-seeking portfolio was approximately

21 pct during the 2011 to 2018 period when risk was low, approximately 33 pct in the 2018 to 2025 window, and 41 pct at year-end 2025. All else equal, a lower risk level over the strong market period during 2011 to 2018 (see Section 7.2) delivered lower cumulative returns. Although the Risk-seeking portfolio outperformed a 60-40 over this period, it would have performed even better if risk had not been reduced from 2011 to 2018.

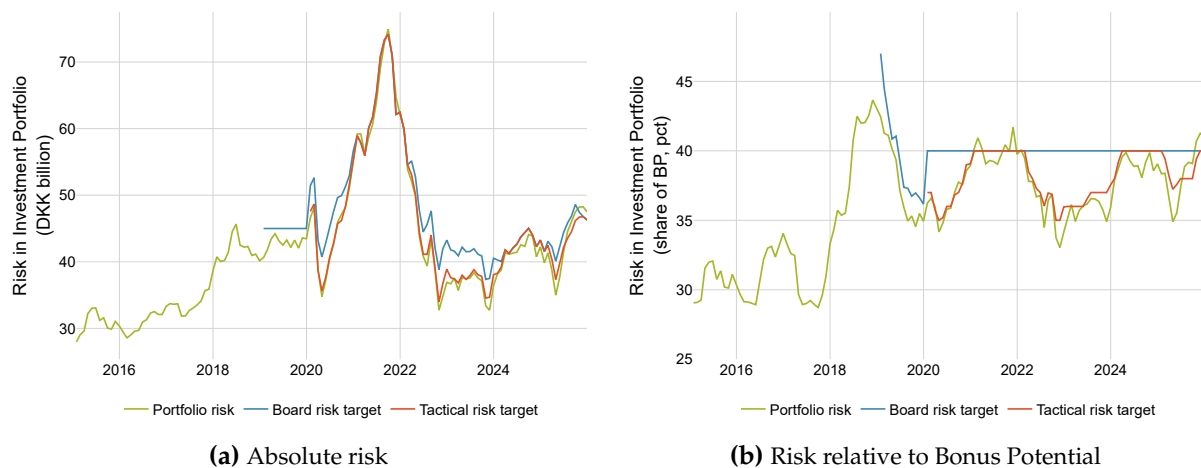


Exhibit 7.19: Actual risk and risk targets for the Investment Portfolio. The figure illustrates the actual risk in the Investment Portfolio, along with the Supervisory Board target and the tactical target. Panel (a) illustrates the risk in absolute terms, where Panel (b) measures the risk relative to the Bonus Potential. Prior to 2019, ATP did not operate with explicit Supervisory Board risk target, but rather only a risk budget.

The Investment Portfolio is the natural focus for evaluating ATP's risk-taking record: it was ATP's only Risk-seeking portfolio before 2022 and remains the largest source of liquid investment risk under the new business model. Exhibit 7.19 reports the Investment Portfolio's realized risk against the risk target and the tactical target given by the Supervisory Board, in absolute DKK terms (Panel (a)) and relative to the Bonus Potential (Panel (b)). Prior to 2019 ATP operated only with a risk budget rather than an explicit Board target; in 2019 the target was expressed as a fixed DKK amount; and since 2020 the target has been expressed as a percentage of the Bonus Potential. Over the 2020–2025 window covered by the formal framework, realized risk has tracked the tactical target closely. Deviations have been modest and mainly reflect gradual rebalancing to reduce transaction costs and active positioning in alternative risk premium strategies, especially during stress periods such as Covid and the 2022 inflation and rates shock.

Factor risk targets

ATP broadly implemented the factor risk exposure targets set by the Supervisory Board. Exhibit 7.20 compares the realized factor allocation in the liquid pool with the long-term targets for Equity, Rates, Inflation, and the Other factor. Overall, ATP maintained a diversified factor

profile as reflected in the factor risk targets. Deviations from target reflect changes in the formal target framework over time, tactical positioning within authorized ranges, and implementation constraints, especially in the Other factor. The exception is the allocation to the Other factor where realized exposure has generally been below the long-term target. The Other factor consists of alternative risk premiums and defensive strategies that are more complex to design, scale, and monitor than the three other factors (see Section 6.3). ATP decided that the short-term implementation of the Other factor should be at lower risk targets until strategies in the Other factor were more developed. Consequently, the allocation to the Equity, Rates, and Inflation factors were slightly overweight compared to their long-term targets. Overall, ATP largely met its factor risk targets, but this is evidence of implementation success rather than evidence that the factor premiums were attractive over the evaluation period.

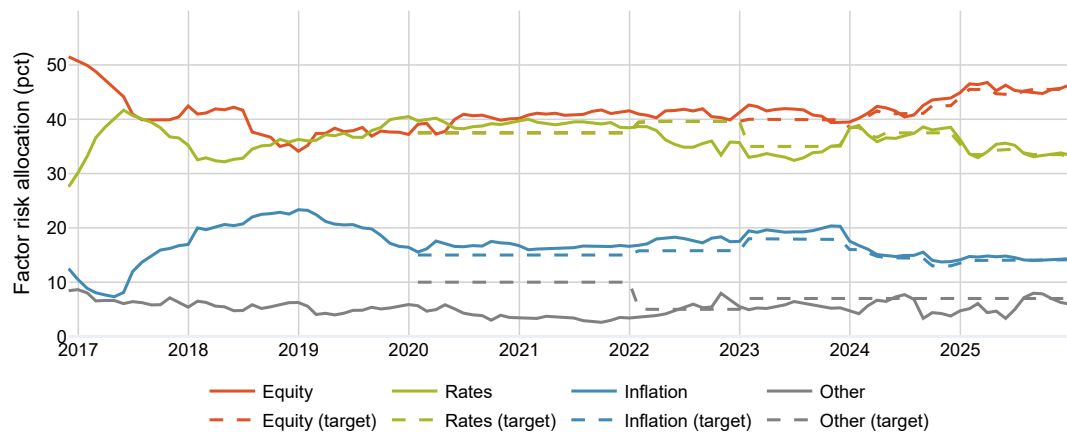


Exhibit 7.20: Factor allocation in the liquid pool compared to long-term Supervisory Board targets. The figure illustrates the allocation to liquid factors and compares them to the long-term targets set by ATP's Supervisory Board.

ATP's illiquid factor allocation has been more skewed to the Equity factor than the liquid pool throughout the evaluation period, and the Board revised the illiquid factor targets in 2022 and 2023 to formalize that separation. Exhibit 7.21 reports the implied factor distribution alongside the long-term Supervisory Board targets for the illiquid portfolio. The illiquid factor allocation is implied by ATP's risk model, mapping the risk in each illiquid asset to the Equity, Rates, and Inflation factors, with a separate Other factor modeling the illiquidity premium itself. The factor allocation has drifted over time, reflecting both portfolio developments, including the rising share of Private equity, and changes in the risk model, which have made infrastructure investments more equity-heavy than in earlier classifications. Relative to the original targets, the illiquid pool was overweighting the Equity factor until the Board revised the targets in 2022 and 2023. Without the revision, the illiquid portfolio would have been too concentrated in Real estate (because Real estate is the illiquid asset class that delivers a combination of Equity, Rates,

Inflation, and illiquidity exposure). The more Equity factor-skewed illiquid target is therefore a deliberate way to preserve factor discipline while avoiding excessive asset-class concentration. After the revisions, the illiquid pool's factor allocation has been broadly consistent with factor risk targets.

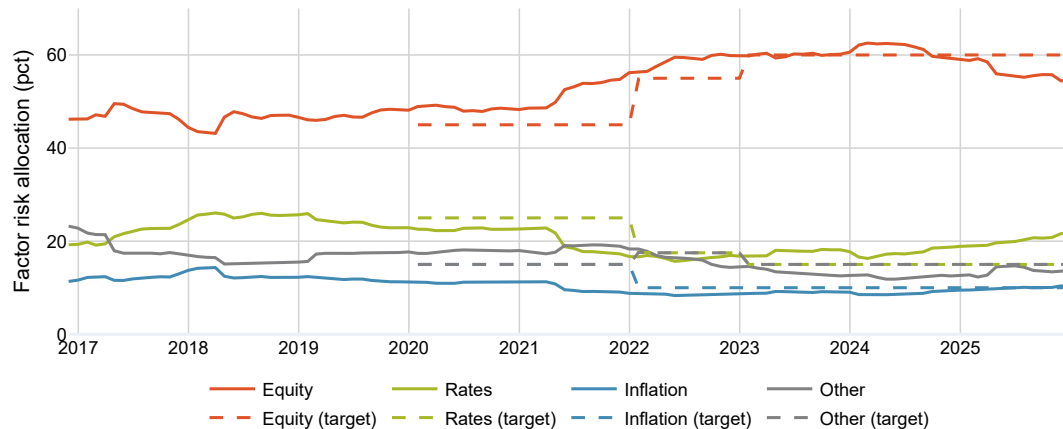


Exhibit 7.21: Factor allocation in the illiquid pool compared to long-term Supervisory Board targets. The figure illustrates the allocation to illiquid factors and comparing them to the long-term targets set by ATP's Supervisory Board.

7.5.3 Leverage over time

ATP's leverage has varied over time, rising before 2020–2021, falling sharply in 2022 as interest rates increased and exposures decreased, and then increasing again to a new higher level in 2025 under the new business model. This section shows how much risk and leverage ATP has taken, and how leverage appears in the current balance sheet. The level of leverage at any point in time is the joint outcome of three factors: the size of the Bonus Potential relative to guaranteed benefits, the absolute level of risk adopted by the Supervisory Board, and the implementation choices made within the Risk-seeking Portfolios. The section should be read and interpreted in the context of Sections 6.4 and 6.5 on why ATP needs to take leverage to fulfill its commitments and Section 6.6 on how ATP takes leverage. We further assess ATP's leverage in Section 7.7.1.

ATP's balance sheet exposure—the total economic positions ATP has on its balance sheet with both cash assets and derivative exposures (rather than accounting book value or market value)—rose from 2017 to 2021, fell in 2022, and increased again through to 2025, as shown in Exhibit 7.22. Exposures rose from 2017 to 2020 because ATP increased risk-taking in the Investment Portfolio (Section 7.5.2), market values rose as asset prices performed strongly and the low-interest rate environment kept the market value of the guaranteed liabilities and corresponding Interest Rate Hedge Portfolio high (Section 7.2). The peak exposure is in 2020 of DKK 1,448 billion on a balance sheet of DKK 960 billion. The decline in 2022 reflects the rise in

interest rates during this time (see Section 7.2), and the corresponding reduction in the market value of ATP's balance sheet and hedge exposure. The increase in exposures from 2022 to 2025 is partly due to the implementation of the new business model, which was gradually introduced from 2023—we further comment on the Supplementary Hedge Portfolio and the Market Return Portfolio in Section 7.7.6, which shows that the increase in leverage was a deliberate choice by ATP separate from the introduction of the Long-term Supplementary Reserve and the Life Annuity with Market Exposure. Since 2022, Exhibit 7.22 shows that a large share of ATP's exposure comes from derivative exposures used to implement the Risk-seeking Portfolios under the new business model.

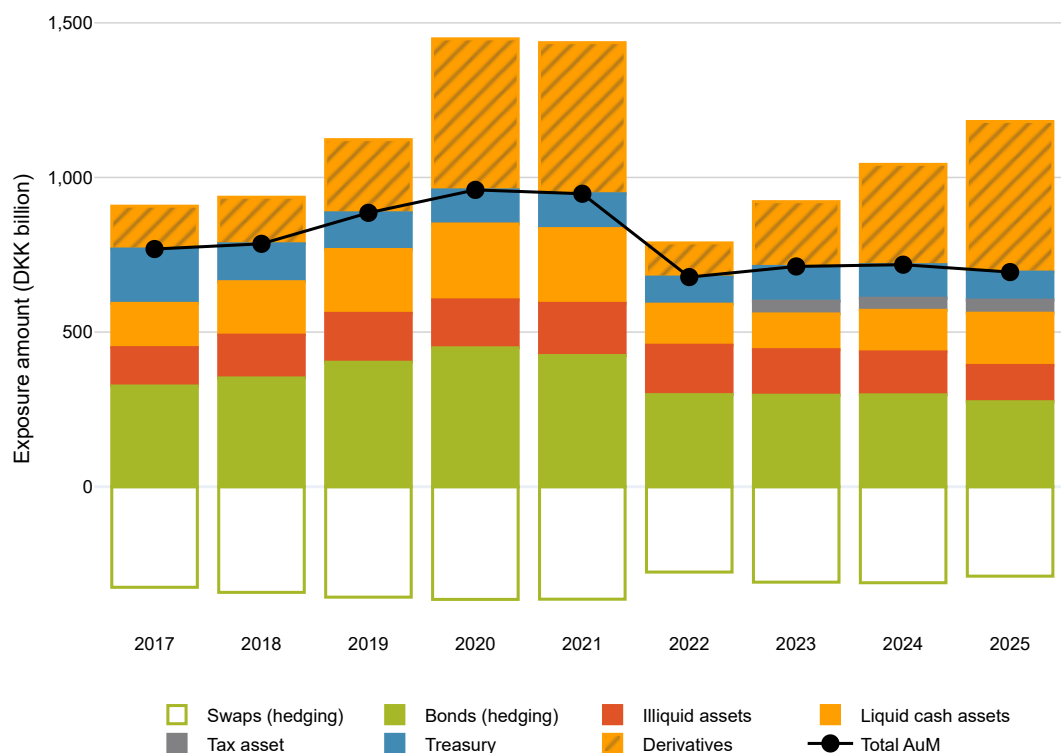


Exhibit 7.22: ATP's historical leverage. The figure illustrates the decomposition of ATP's assets and the resulting leverage.

ATP's leverage has increased since 2022, but liquidity buffers have remained adequately positive. Exhibit 7.23 shows that gross leverage and net leverage both rose in 2020 and 2021, fell in 2022, and then increased to their highest levels in 2025. (See Section 6.6.1 for various definitions of leverage.) Gross leverage and net leverage move together, which implies that most leverage changes occur because of a broad expansion and contraction of exposure rather than changes in cash assets. It is worth noting that net leverage has changed faster than gross leverage, especially from 2024 to 2025. Over the period from 2024 to 2025 gross leverage changed from $2.17\times$ to $2.40\times$ and net leverage changed from $1.73\times$ to $1.99\times$. This means that ATP has added exposures not matched by proportional increases in cash or offsetting positions, con-

sistent with the larger exposures taken with the introduction of the new business model. Put another way, the new business model has led to ATP's balance sheet to become more "fully deployed." Exhibit 7.23 also shows that unencumbered cash moves countercyclically to net and gross leverage, as expected because higher leverage requires more cash. Nevertheless, unencumbered cash has always remained above 10 pct of the balance sheet from 2017 to 2025. This also highlights a "right-way-risk," as ATP can choose to lower risk to preserve liquidity buffers.

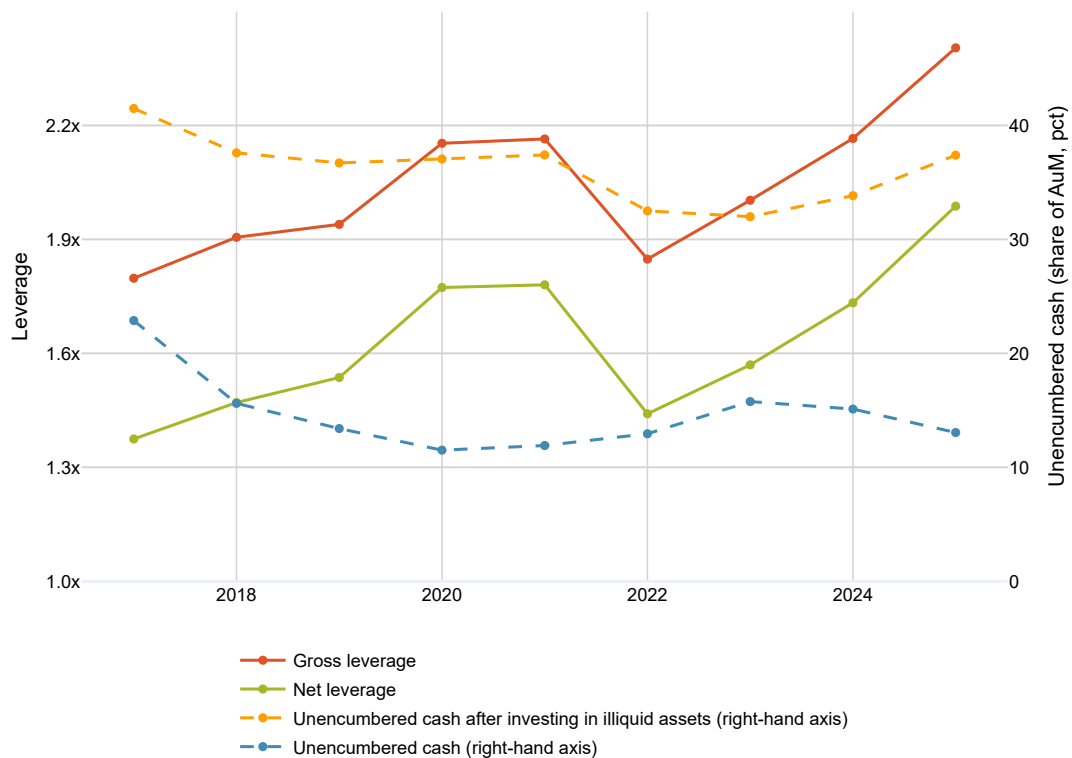


Exhibit 7.23: ATP's historical leverage. The figure shows gross and net leverage as a proportion of ATP's balance sheet, along with unencumbered cash. Gross leverage measures the total scale of exposures and sums the absolute value of positions. Net leverage adjusts for cash and offsetting positions. See Section 6.6.1 for details regarding the definitions and uses of the leverage measures.

Measuring leverage relative to the Investment Portfolio—which is the risk-bearing part of the portfolio that absorbs gains and losses—leverage is, by design, high and has ranged from approximately 4× to 6× over 2017 to 2025, as shown in Exhibit 7.24. Leverage peaked in 2020 at 6.1× during Covid and reached a low in 2022 at 3.9× when interest rates spiked and equity and bond markets fell (Section 7.2). The 2022 decline in leverage reflects the rates-shock contraction of both the investment assets and BP, with exposure falling more than BP because of de-risking (see also Section 7.5.2). Leverage increases from the low in 2022 to approximately 5.3× in 2025, coincident with the adoption of the new business model (see below in Section 7.7.6). The composition of leverage has also changed. In 2022, illiquid assets represented a much larger

share of Investment Portfolio exposure because liquid derivative and cash exposures could be reduced quickly while illiquid exposures could not. The much larger exposure of illiquid assets in 2022 was due to the leverage reduction in liquid derivatives and cash assets, which declined to exposures of 107 pct and 132 pct, respectively, from 306 pct and 128 pct in 2021 as illiquid assets could not be reduced in response to the shock. Liquid cash assets, however, declined but remained relatively high—consistent with the high levels of unencumbered cash in Exhibit 7.23.

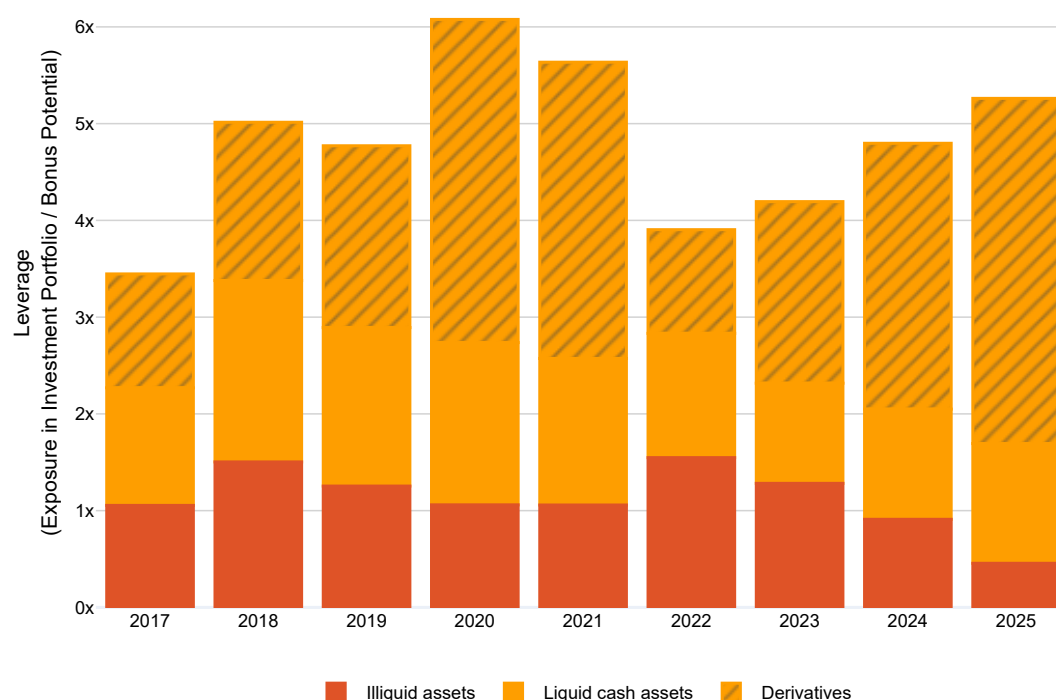


Exhibit 7.24: ATP's historical leverage in the Investment Portfolio. The figure shows the leverage in the Investment Portfolio, along with which types of assets which constitute the leverage.

Since 2022, Investment Portfolio leverage has risen again, reaching approximately 5.3 $\times$ at end-2025, coincident with the adoption of the new business model over this period. The increase has come mainly through a larger derivative portfolio rather than a larger illiquid allocation. Since 2022, the risk exposure from illiquid assets has decreased from approximately 40 pct in 2022 to approximately 10 pct at end-2025, reflecting the takedown of illiquid assets in the ATP portfolio (also see Section 7.6.5). This composition means that the recent rise in leverage increases market exposure, but it is more liquid and more directly adjustable than the illiquid-heavy exposure profile observed during the 2022 stress period.

7.6 Performance on investments

Key message

Over 2015–2025, ATP's Interest Rate Hedge Portfolio performed as designed, closely tracking the guaranteed liabilities it hedges, while its Risk-seeking Portfolios delivered positive returns but underperformed a conventional 60-40 equity-bond portfolio on a risk-adjusted basis; its illiquid portfolio earned a modest realized illiquidity premium over the same reference. The shortfall in liquid assets reflects ATP's deliberate factor construction—less exposure to equities, which performed strongly over the period, and more exposure to fixed income, which performed poorly, especially in 2022—rather than weak implementation within asset classes, where ATP has generally tracked or modestly outperformed its reference indices.

We evaluate ATP's investment performance against three simple reference portfolios (global equities, global fixed income, and a 60-40 mix) and against asset class-specific reference indices, guided by simplicity but mindful of the limitations that return comparisons entail. Because ATP does not operate with formal benchmarks (see Section 6.7), these references are passive, investable alternatives rather than governance hurdles, and all comparisons are ex post. To compare investments that combine cash assets and derivatives on a common basis, we scale returns to a constant ex-ante volatility, and we use alpha, beta, and appraisal ratios to assess whether active risk-taking was rewarded.

ATP's Interest Rate Hedge Portfolio has performed as designed, closely tracking the value of the guaranteed liabilities it hedges. Its losses, including the large losses of 2022, are the counterpart to offsetting reductions in the market value of those liabilities rather than evidence of a failed hedge—a close tracking that is non-trivial given the absence of truly long-dated assets.

ATP's four-factor portfolio (Equity, Rates, Inflation, and Other) earned positive returns over 2017–2025 but performance was uneven across factors and trailed a 60-40 portfolio on both return and risk-adjusted metrics, with the shortfall most pronounced over 2020–2025. The Equity factor was the strongest contributor, the Inflation factor proved a valuable diversifier through the post-2020 inflation shock, and the Rates and Other factors disappointed; ATP's deliberate underweight to the Other factor added value given its weak realized performance.

ATP's total liquid portfolio materially underperformed the 60-40 portfolio over 2015–2025, with a Sharpe ratio of 0.41 against 0.68, driven by its larger exposure to fixed income and smaller exposure to equities during a period of strong equity and weak bond

Key message (continued)

returns. Within asset classes, however, ATP's implementation was broadly in line with, or ahead of, market-capitalization-weighted references for most asset classes, with the notable exceptions of Foreign equities, Global fixed income, and Inflation-related assets. After controlling for reference-market exposure, active implementation was generally positively compensated outside those three asset classes.

For illiquid assets, where evaluation is less straightforward and smoothed valuations complicate short-term comparisons, ATP's investments modestly outperformed their liquid references, with a weighted-average public market equivalent of 1.07 and an annualized realized illiquidity premium over the 60-40 portfolio of less than 1.0 pct. Private equity and Infrastructure outperformed their public-market equivalents, and Private credit and Real estate outperformed their asset-specific references. ATP's largest direct investments, four deals each exceeding DKK 2 billion in commitments, detracted from overall performance. These comparisons are shown both with and without ATP's modelled illiquidity charge of less than 1.0 pct per year at year-end 2025, which is set conservatively and below the illiquidity premiums implied by theoretical portfolio choice models.

7.6.1 Performance measures

This section describes our overall approach to evaluating ATP's investment performance. We are guided by simplicity, but return comparisons are not always simple, and we will discuss benchmarks and various limitations and subtleties next.

Benchmarks and reference indices

For all ATP portfolios, we use three simple benchmarks: 1) Global Equities; 2) Global Fixed Income; and 3) a 60-40 portfolio (that is, a 60-40 mix of global equities and global fixed income). The 60-40 portfolio is rebalanced monthly.

For all ATP asset classes in liquid and illiquid assets, we also use asset class-specific benchmarks. Exhibit 7.25 lists all liquid asset classes with a brief description, the risk share allocated to the asset class, the sample period (determined by data availability), and the reference index we use as a benchmark. The asset class Global equities consists of the two sub-asset classes Foreign equities and Danish equities. In general, ATP has detailed and frequent data from the beginning of 2015. However, due to risk systems and data availability, the sample period starts in 2017 for some investments (for example, for Danish mortgage bonds) to make reasonable comparisons against the reference index.

Review of ATP's Investment Strategy

Exhibit 7.25: ATP liquid asset classes and reference indices. The table presents ATP's liquid asset classes, their risk share, and data availability. Danish equities and Foreign equities constitute Global equities. Hence, the risk shares in the table sum to 100 pct when including Global equities, but excluding Danish equities and Foreign equities. It also shows the chosen reference index, data source, and Bloomberg Ticker. For Balanced mandates, the data source is Hedge Fund Research. When the applied equity indices are "net returns," where local withholding taxes have been deducted, 0.5 pct of annual returns have been added to reflect ATP's efficient handling of double taxation. The effect of this is a return series close to "gross returns," which may be slightly conservative on older observations, where double taxation was more likely in some jurisdictions.

ATP asset class	Description	Risk share (end-2025)	Sample period	Reference index	Ticker
Global equities	All of ATP's equities (that is, both Danish and foreign).	44.2 pct	2015–2025	MSCI ACWI (100 pct hedged to EUR).	MACXUIGB
Danish Equities	ATP's Danish equities (subset of Global Equities).	9.1 pct	2015–2025	OMX Copenhagen KAX CAP Total Return.	KAXCTR
Foreign equities	ATP's Foreign equities, including equity derivatives (subset of Global equities).	35.1 pct	2015–2025	MSCI ACWI (100 pct hedged to EUR).	MACXUIGB
Public credit	ATP's Public credit (that is investment grade, high yield and emerging markets); includes both cash bonds and derivatives.	6.2 pct	2015–2025	Bloomberg Global High Yield Index.	LG30TREH
Global fixed income	ATP's Global Fixed Income (that is, "non-defaultable" bonds and interest rate derivatives).	29.8 pct	2015–2025	Bloomberg Global Treasury Bond Index.	BTSYTREH
Danish mortgage bonds	ATP's Danish mortgage bonds; includes both callable and non-callable bonds.	2.0 pct	2017–2025	Nordea MBS Index.	NDEAMTGM

Review of ATP's Investment Strategy

Exhibit 7.25 (continued)

ATP asset class	Description	Risk share (end-2025)	Sample period	Reference index	Ticker
Inflation-related	ATP's implementation, which includes inflation-linked bonds, inflation swaps, but also historical payer swaption positions.	8.0 pct	2015–2025	62.5 pct Markit iBoxx EUR Breakeven Euro-Inflation France & Germany Sovereigns Total Return Index & 37.5 pct Markit iBoxx USD Breakeven 10-Year Inflation Index Nominal.	IBXXEBF1 & IBXXUBF1
Commodities	ATP's commodities.	8.9 pct	2017–2025	S&P GSCI Total Return.	SPGSCITR
Balanced mandates	ATP's external hedge fund mandates.	0.9 pct	2015–2025	Mean of 9 multi asset HFR Funds.	N/A

Exhibit 7.26 lists all illiquid asset classes with corresponding information.

Exhibit 7.26: ATP illiquid asset classes and chosen reference indices The table presents ATP's illiquid asset classes, their risk share, and data availability. It also shows the chosen reference index, data source, and Bloomberg Ticker.

ATP asset class	Description	Risk share (end-2025)	Sample period	Reference index	Ticker
Private equity	All of ATP's private equity investments (that is, both Danish and foreign).	49.2 pct	2015–2025	50 pct FTSE Russell 2000 & 50 pct Eurostoxx 600.	RU20EUHI & SXXR
Private credit	Levered credit investments and unlevered loans to credit funds.	2.4 pct	2015–2025	S&P Global Leveraged Loan Index.	SPLGAL
Infrastructure	All of ATP's infrastructure investments (that is, both Danish and foreign).	19.5 pct	2015–2025	S&P Global Infrastructure Index.	SPGTINEH
Real estate	Primarily direct investments in Danish real estate.	28.9 pct	2015–2025	FTSE EPRA Euro Zone Public Real estate.	RPEU

ATP has not defined formal benchmarks for its asset classes (see Section 5.6 on governance). This is a deliberate feature of ATP's approach rather than an oversight: portfolio managers are not measured against, or mandated to track, a predefined index. The reference indices we use throughout this chapter are therefore not benchmarks in the governance sense—they are not objects ATP has committed to beat or replicate. We instead use them as reference portfolios: market-conforming indices that represent a passive, investable alternative to ATP's active positioning in each asset class. We use the same reference indices ATP itself reports to its Supervisory Board, so that our comparisons rest on the same yardsticks ATP uses internally. All such comparisons are, by construction, ex-post evaluations.

Returns on reference indices do not include the costs of implementing the liquid references in practice. ATP returns are all net of fees paid to external managers but not internal costs. See Section 7.7.8 for a detailed analysis of costs.

Volatility-scaled returns

To make ATP's investment returns comparable with those of reference portfolios, we adjust for profits and losses from derivatives and scale all returns to a common level of volatility. There are two complexities when comparing returns on ATP investments with returns on reference indices. First, different investments have different levels of total risk. They may also have different degrees of leverage, which further widens these differences. For example, the risk levels of ATP's portfolios differ from those of a standard 60-40 portfolio (see Section 6.6). To address this, we rely on the classic Sharpe ratio (the slope of the capital allocation line; see Section 4.4.1), which measures average excess return per unit of volatility and thereby accounts for total risk. Second, returns on derivative assets (such as futures and swap contracts) are more complex and context-dependent to define; futures and swap contracts, for instance, have initial market values of zero, so a standard return calculation is not defined. Because ATP implements its investments in a combination of cash assets and derivatives, its returns are not directly comparable to a standard benchmark return. To overcome these two complexities, we adjust for derivatives profits and losses and construct volatility-scaled returns.

We present returns as 10 pct ex-ante volatility returns. Let r_t and $r_{f,t}$ denote the return on a cash asset and the risk-free return over period t (from date $t - 1$ to date t). For any given position (in an asset or portfolio of assets), let PnL_t denote the profit and loss over period t , $Financing_t$ the financing cost over period t , and $\sigma_{PnL,t-1}$ the annualized standard deviation of the profit and loss at the beginning of the period. Note that profit and loss, financing cost, and standard deviation of profit and loss are all measured in DKK. A volatility-scaled return with

volatility target v (for example, $v = 10$ pct) is then given by:

$$r_{v,t} = r_{f,t} + v \cdot \frac{PnL_t - Financing_t}{\sigma_{PnL,t-1}}.$$

For investments in cash assets only with a return r_t and annualized return volatility at the beginning of the period $\sigma_{r,t-1}$, the volatility-scaled return can be written as:

$$r_{v,t} = r_{f,t} + v \cdot \frac{r_t - r_{f,t}}{\sigma_{r,t-1}}.$$

The ratio multiplying v in the last expression is the excess return divided by the ex-ante volatility and resembles the Sharpe ratio (though for one period). Volatility scaling (through leverage) corresponds to movements along the capital allocation line by varying the volatility target v for the risky tangency portfolio (see Section 4.4.1). Note that for an investment including derivatives this simplification cannot be applied as it is not well defined (for example, futures contracts or swaps have initial market values of zero).

Several implementation choices govern how we compute cumulative returns, the risk-free rate, and volatility scaling. We apply compounding to cumulate return over the sample period (subtracting the initial commitment to reflect returns rather than index values). We use ATP's internal financing rate, which is an average of short-term swap and government bond yields, as the risk-free rate of return. The asset volatility is based on an expanding window of weekly returns since end-2007. For ATP portfolios, the volatility scaling is calculated daily, whereas for the reference indices, the returns are calculated monthly. The difference is due to the varying risk level in ATP portfolios, which even within months can show substantial variation.

Alpha, beta, and appraisal ratio

While volatility adjusts for the total risk level, a beta adjusts for marginal (covariance) risk and gives an alpha. Even if ATP has not directly implemented a benchmark approach, the investment approach is inherently active. To evaluate the value of this active risk-taking, we run standard performance regressions with monthly data:

$$r_t - r_{f,t} = \alpha + \beta (r_{b,t} - r_{f,t}) + \varepsilon_t,$$

where $r_t - r_{f,t}$ is the excess return on the relevant investment (either the cash asset return or the volatility-scaled return), $r_{b,t} - r_{f,t}$ is the excess return on the relevant benchmark (reference index), and ε_t is the regression residual. The regression slope, β , is the exposure to the benchmark. The regression constant alpha, α , is the investment's excess return over and above the benchmark's excess return while controlling for the β exposure. Hence, the α measures whether

ATP's implementation outperforms the benchmark index after adjusting for how much β exposure ATP actually had to the benchmark. Active deviations from the benchmark result in active risk, which is captured by the volatility of the regression residual ε_t , and denoted with σ_ε .

The appraisal ratio is a reward-to-variability measure for active risk-taking. It equals:

$$\text{Appraisal ratio} = \frac{\alpha}{\sigma_\varepsilon},$$

and is part of the classic [Treynor and Black \(1973\)](#) model. If ATP invested in the benchmark itself, there would be no residual in the regression and risk-taking in the sense of actively deviating from the benchmark would be zero. Once the strategy deviates from the benchmark, there is active risk, and the appraisal ratio measures the reward in expected return per unit of active risk. It should be recalled that the appraisal ratio links the improvement in Sharpe ratios from only investing in the benchmark to an investment in an optimal mix of the benchmark and the active investment (see Section 4.4.3). We present annualized alphas and appraisal ratios.

7.6.2 Interest Rate Hedge Portfolio

ATP's Interest Rate Hedge Portfolio has matched the interest rate sensitivity of highly volatile guaranteed liabilities. Exhibit 7.27 reports the annual changes in the value of the Interest Rate Hedge Portfolio alongside the annual changes in the value of the guaranteed benefits, starting in 2006. The two series move closely together year by year. This is the central point for interpreting the Interest Rate Hedge Portfolio performance: asset side losses on the Interest Rate Hedge Portfolio cannot be viewed in isolation because they are the counterpart to changes in the market value of the liabilities being hedged. The large Interest Rate Hedge Portfolio losses in 2022, a year of sharp interest-rate increases (Section 7.2), is not evidence of a failed hedge; they correspond to a similar reduction in the market value of the guaranteed liabilities. This close tracking is non-trivial to achieve: ATP has no access to truly long-dated assets (nor does any investor) and is exposed to yield-curve risk at maturities where the discount curve is constructed by extrapolation.

Review of ATP's Investment Strategy

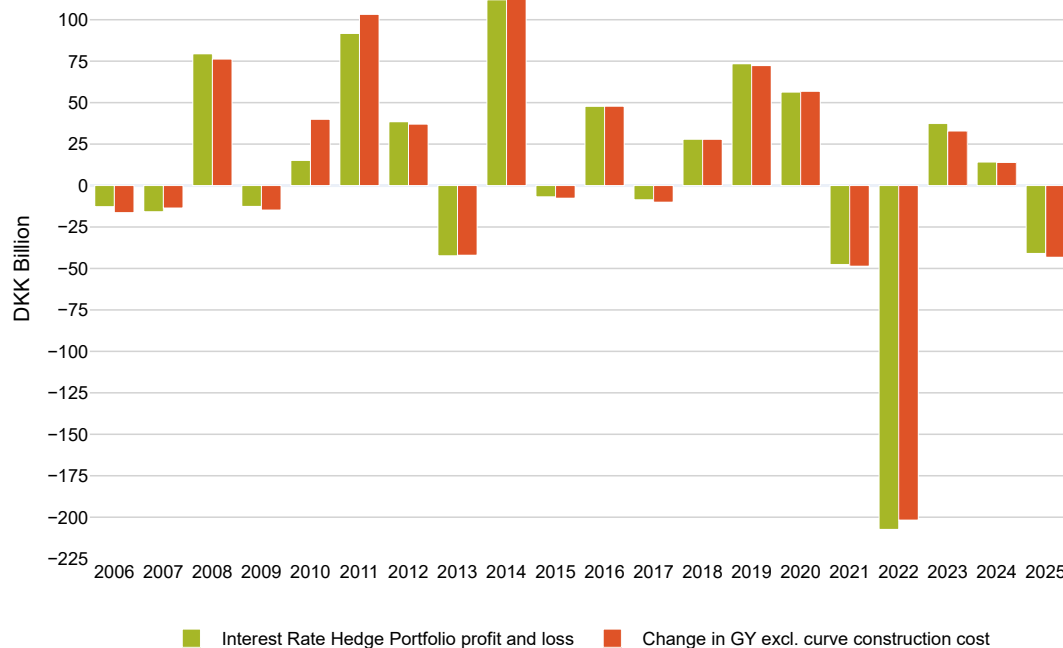


Exhibit 7.27: Interest Rate Hedge Portfolio versus guaranteed benefits. The green bars depict yearly changes in the value of the Interest Rate Hedge Portfolio (corrected for the funding cost of the tax asset, see Section 5.5.4). The red bars depict yearly changes in the value of guaranteed benefits (corrected for the cost of carry arising from liability cash flows rolling from the extrapolated part of the discount curve to the market part as time progresses, see Section 5.5.2). The sample starts in 2006, which was the first year in which ATP decomposed the total portfolio into an Interest Rate Hedge Portfolio and an Investment Portfolio.

7.6.3 Factors

Over the evaluation period from 2017 to 2025, ATP's four-factor portfolio earned positive excess returns of DKK 44 billion with individual returns of DKK 76 billion on Equities, DKK –60 billion on Rates, DKK 32 billion on Inflation, and DKK –4 billion on the Other factor. Section 6.3 made the ex-ante case for ATP's factor-based investment framework, using long historical backtests, regime analysis, and robustness tests. This section asks the ex-post question: what was the performance of the four factors, and how did the realized factor portfolio compare to a conventional 60-40 portfolio? In this analysis, we only consider factors in the liquid portfolio. Since ATP has only been a factor investor since 2017, our evaluation starts at the beginning of 2017.

ATP's factor performance

ATP's liquid factor portfolio delivered positive returns over 2017 to 2025, but performance was uneven across factors and weaker than a conventional 60-40 equity-bond portfolio. Exhibit 7.28 reports cumulative Equity, Rates, Inflation, and the Other factor returns scaled to 10 pct ex-ante volatility over 2017–2025 and Exhibit 7.29 reports summary statistics of factor

returns over the same period. Overall, the out-of-sample performance is weaker than the historical backtests (Section 6.3), but caution is needed because factors—even the simple aggregate equity market—can underperform for long periods for a decade or more (Section 4.2.1). The Equity factor was the strongest contributor, benefiting from the broad rise in global equity markets over most of the evaluation period but ATP's implementation lagged a 60-40 portfolio because, as Sections 6.3.3 and 6.3.4 describe, ATP's implementation is underweight the US and deviates significantly from market-cap weights, which was costly in a period when US equities, especially large-cap US equities, strongly outperformed. (ATP's Equity factor also includes corporate credit.) The Rates factor exhibited positive performance until 2022 and then experienced a drawdown as interest rates rose that year. The Inflation factor also delivered positive returns and was an important diversifier during and after the inflation shock beginning in 2020—this is a point of validation for ATP selecting this factor because of its diversification properties even though its long-run performance is weaker than other factors (Section 6.3.2). Finally, Other factor also disappointed relative to the historical evidence in Section 6.3: it was intended to provide diversified alternative risk premiums and defensive strategies, but realized returns were weak over 2017–2025. In particular, the Other factor did not offer diversified positive returns during 2022 when equity and bond markets poorly performed. ATP had lower exposure to the Other factor (Section 7.5.2, Exhibit 7.20) to phase in exposure over time; this deliberate underweight to the Other factor was value-added given the Other factor's weak performance.

Review of ATP's Investment Strategy

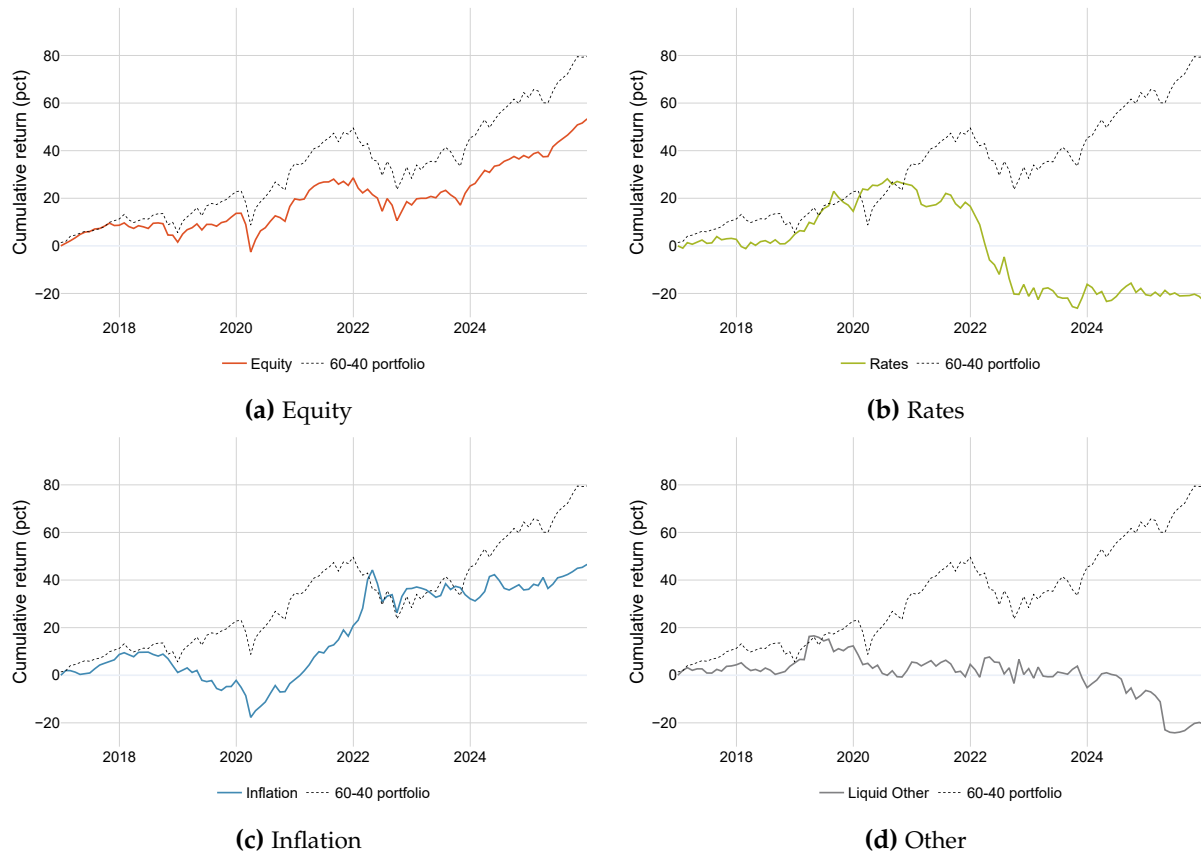


Exhibit 7.28: Returns on ATP's liquid factors scaled to 10 pct volatility. The exhibit illustrates the returns on ATP's four liquid factors, with the Equity factor in Panel (a), the Rates factor in Panel (b), the Inflation factor in Panel (c) and the Other factor in Panel (d). Returns are from 2017–2025. ATP has been a factor investor since 2017.

ATP's liquid factor portfolio, which combines the four Equity, Rates, Inflation, and Other factors, underperformed the 60-40 equity-bond reference portfolio on both return and risk-adjusted metrics, with the shortfall especially pronounced over 2020–2025. Exhibit 7.29 shows that scaled to 10 pct ex-ante volatility, the liquid factor portfolio returned 4.0 pct per year over 2017–2025, with a Sharpe ratio of 0.28 and a maximum drawdown of 31.1 pct, compared with 6.8 pct, 0.70, and 17.3 pct, respectively for the 60-40 portfolio. Over 2020–2025, ATP's liquid factor portfolio returned 2.4 pct per year, with a Sharpe ratio of 0.07 compared with 6.9 pct per year and a Sharpe ratio of 0.57 for the 60-40 portfolio.

Exhibit 7.29: Performance of ATP's liquid factor portfolio versus a 60-40 portfolio. Returns are scaled to 10 pct ex-ante volatility. Mean return, volatility and Sharpe ratios are annualized. Panel (a) covers 2017–2025 and Panel (b) covers 2020–2025.

	Arithmetic mean return (pct)	Realized volatility (pct)	Sharpe ratio	Max. drawdown (pct)
Panel (a): 2017–2025				
ATP liquid factor portfolio	4.0	11.2	0.28	31.1
60-40 portfolio	6.8	8.5	0.70	17.3
Panel (b): 2020–2025				
ATP liquid factor portfolio	2.4	13.2	0.07	31.1
60-40 portfolio	6.9	9.5	0.57	17.3

Although ATP's factor framework offers diversification and high long-run returns in design, realized performance over this sample for the factors was weak.

7.6.4 Liquid assets

ATP's liquid assets underperformed a 60-40 equity-bond portfolio over 2015–2025 because ATP was underweight equities, which did well during this period, and overweight bonds, which did relatively poorly, especially over 2022. It is important to note that ATP does not make active calls on different asset classes—as Sections 6.3 and 6.7 explain, ATP first decides on Equity, Rates, Inflation, and Other factors to harvest in its Risk-seeking Portfolios and then implements those factors across asset classes. As a guide, Exhibit 7.30 maps the factors to liquid asset classes.

Exhibit 7.30: Asset classes and factors. The table shows how a particular asset class is mapped into factors. X marks the dominant factor of the asset class; (X) marks factor risk in the particular asset class which is typically residual risk from implementation or hedged to the given factor (for example, hedging interest rate risk in a credit bond).

Asset class	Equity factor	Rate factor	Inflation factor	Other factor
Global equities	X			
Danish equities	X			
Foreign equities	X			
Public credit	X	(X)		
Global fixed income		X		
Danish mortgage bonds		X		(X)
Inflation-related			X	
Commodities			X	
Balanced mandates	(X)	(X)	(X)	X
Private equity	X			X
Private credit	X			X
Infrastructure	X	X	X	X
Real estate	X	X	X	X

Performance of the total liquid portfolio

ATP's liquid portfolio trailed 60-40 over 2015 to 2025, with a Sharpe ratio of 0.41 versus 0.68 for 60-40. Exhibit 7.31 reports the cumulative return on ATP's liquid assets alongside global equities, global bonds, and an unlevered 60-40 portfolio, with all series scaled to 10 pct ex-ante volatility. The period 2015–2025 delivered strong equity returns, despite sharp market drawdowns in 2020 due to Covid and in 2022 (Section 7.2). Bonds, by contrast, delivered poor returns and unusually high realized volatility, especially in 2022. This combination was unfavorable for ATP's liquid portfolio because ATP's factor construction carries more Rates exposure than a 60-40 portfolio and less exposure to equity that was well rewarded over the period. However, prior to 2022, Exhibit 7.31 shows that ATP's liquid portfolio had the best performance of the four benchmarks on the same volatility-scaled basis. Since 2022, ATP has significantly trailed the 60-40 portfolio with a Sharpe ratio of -0.25 compared to 0.28 for 60-40 over 2022–2025. This is because of the large allocation by ATP to fixed income in the Interest Rate Hedge Portfolio (which moved one-to-one with the decreasing values of the guaranteed pensions) and the large allocation to the Rates factor in the Investment Portfolio, which had poor performance over this period.

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Exhibit 7.31: Cumulative return on liquid assets at 10 pct ex-ante volatility from 2015–2025. The figure illustrates the returns on all ATP's liquid assets, equities, bonds and a 60-40 portfolio. ATP and the reference portfolios are invested at a 10 pct ex-ante volatility.

The realized volatilities show that the volatility of equities over 2015–2025 was unusually calm and the volatility for bonds was unusually high, see Exhibit 7.32. Over 2015–2025, the realized annualized volatility of equities and bonds were 7.5 pct and 12.6 pct, respectively. This compares to 15 pct and 8 pct, respectively, over a long sample from 1974 to 2025 (see Exhibit 6.4 for North American stocks and bonds). The low volatility of equities is especially unusual given the Covid and interest rate shocks during this period. ATP's liquid portfolio ran at 10.2 pct realized volatility against a 10 pct ex-ante target—almost exactly on target. The Sharpe ratio for ATP (0.41) sits below the equities and 60-40 benchmarks (with Sharpe ratios of 0.74 and 0.68, respectively) because ATP carried more bond exposure over a period when bonds performed relatively poorly.

Exhibit 7.32: Return statistics for ATP and references at ex-ante 10 pct volatility over 2015–2025. The table shows the annualized mean return, the annualized realized volatility, and annualized Sharpe ratio for ATP's liquid assets, equities, bonds, and a 60-40 portfolio.

Portfolios	Arithmetic mean return (pct)	Realized volatility (pct)	Sharpe ratio
ATP liquid	4.9	10.2	0.41
Equities	6.2	7.5	0.74
Bonds	−0.2	12.6	−0.07
60-40 portfolio	6.2	8.1	0.68

Equities

ATP's global equity allocation broadly matched the global benchmark index MSCI ACWI, but Danish equities outperformed its local reference portfolio and Foreign equities underperformed its reference portfolio because ATP's construction of Global equities holds lower exposure to the US than MSCI ACWI (Exhibit 7.33). The underperformance of Foreign equities is the largest single contributor among the asset class level comparisons, reflecting the realized cost of ATP's deliberate diversification away from the US-dominated global benchmark during a period in which US equities dominated.

Review of ATP's Investment Strategy

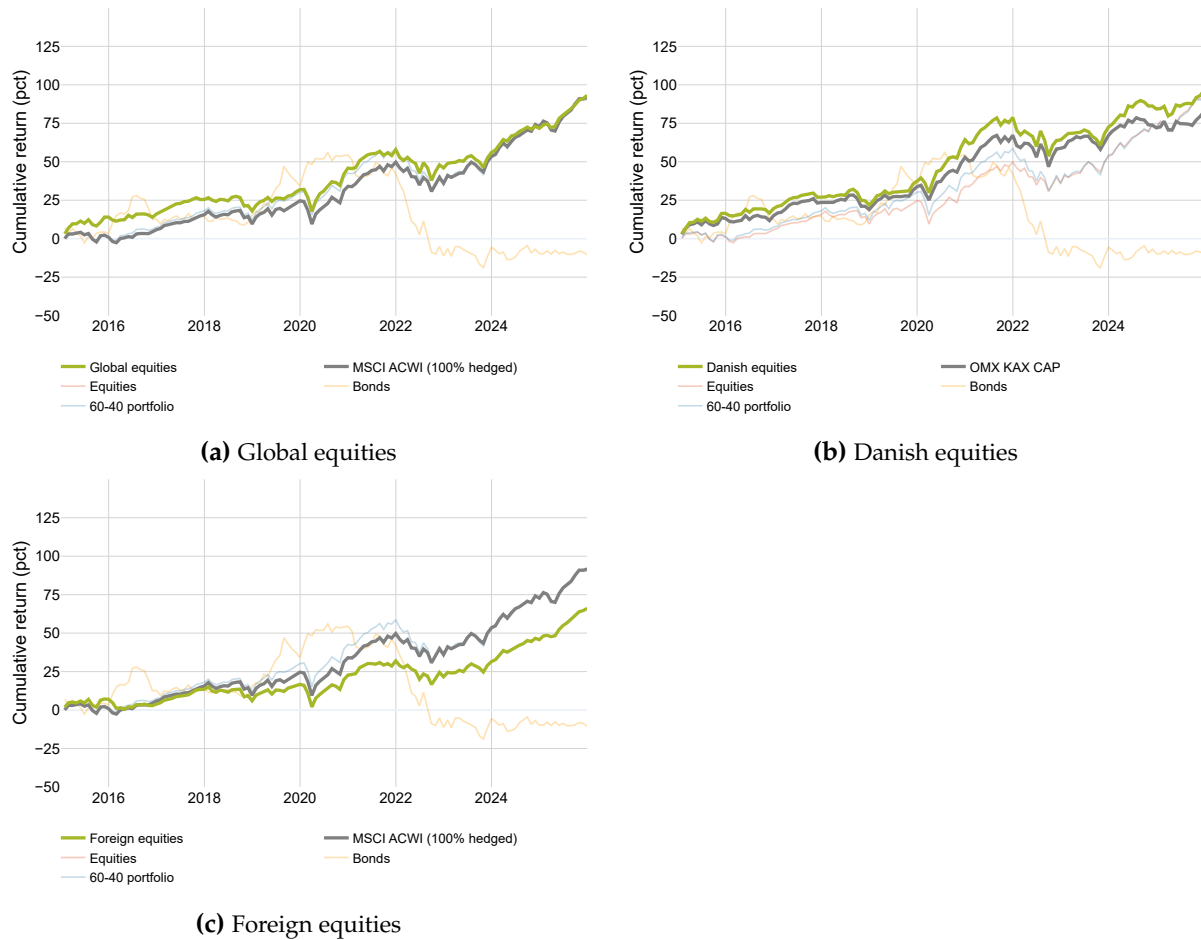


Exhibit 7.33: Cumulative return on equities and their references at 10 pct volatility. The figure illustrates the performance of the asset classes Global equities in Panel (a) and its two sub-components Danish equities in Panel (b) and Foreign equities in Panel (c).

Fixed income

ATP's credit investments outperformed its high-yield reference, while Global fixed income and Danish mortgage bonds showed performance close to their respective references (see Exhibit 7.34). ATP's portfolio of public credit is broader than pure high yield, capturing more general spread risk after hedging interest-rate exposure, and the outperformance partly reflects that broader construction. Global fixed income and Danish mortgage bonds tracked their references closely.

Review of ATP's Investment Strategy

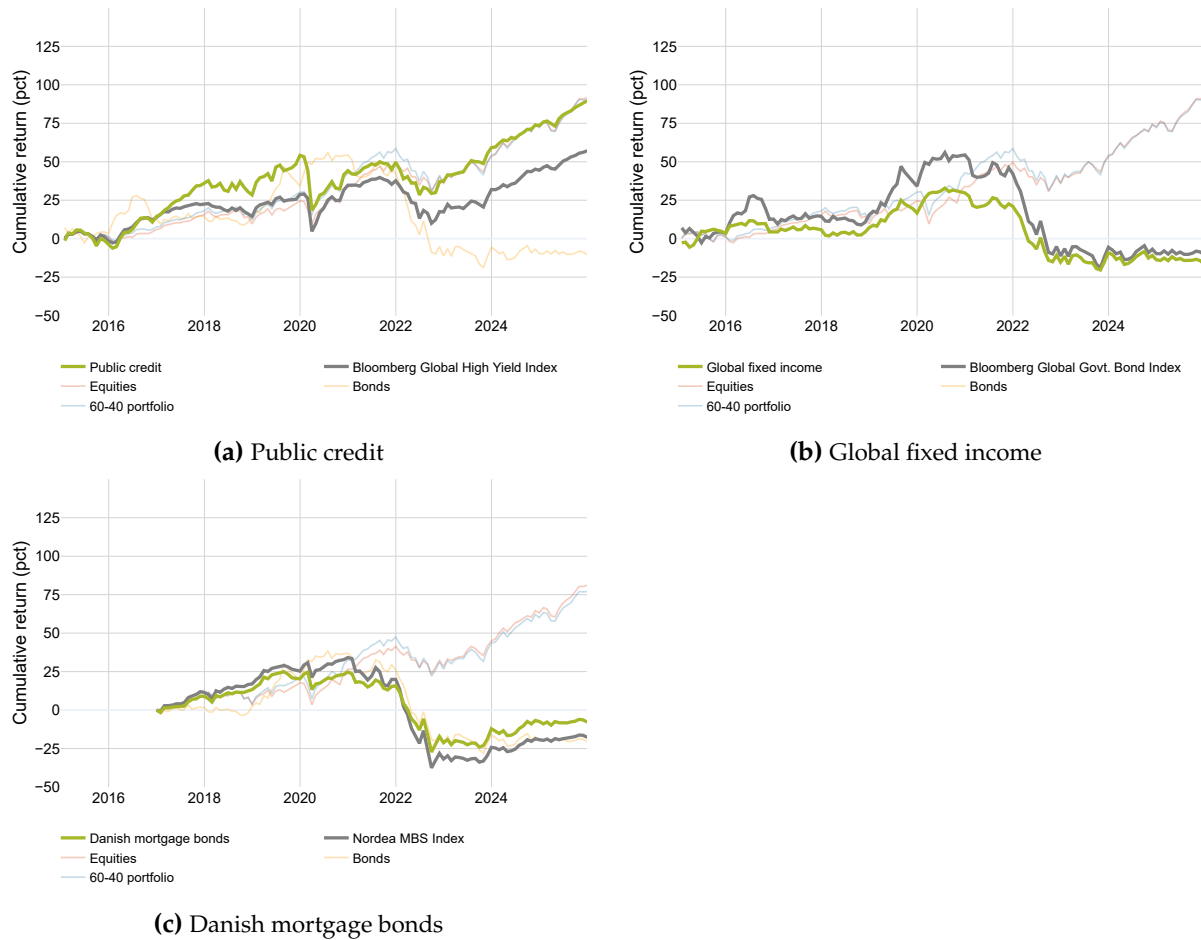


Exhibit 7.34: Cumulative return on fixed income and their references at 10 pct volatility. The figure illustrates the performance of the asset classes Public credit in Panel (a), Global fixed income in Panel (b), and Danish mortgage bonds in Panel (c).

Commodities and alternatives

Commodities outperformed the S&P GSCI reference, with a smaller drawdown in 2022, but the inflation-related portfolio lagged a reference constructed with 10-year tenors, and the balanced mandates were broadly in line with the average of nine multi-asset hedge funds (Exhibit 7.35). For the inflation related strategy, the first part of the return series until 2020 has low volatility with subdued performance; there are strong returns after 2020 in line with the pickup in global inflation due to supply chain disruptions with Covid. The balanced mandate is ATP's hedge fund strategy, which has similar performance to a reference benchmark of an average of nine different multi-asset hedge funds.

Review of ATP's Investment Strategy

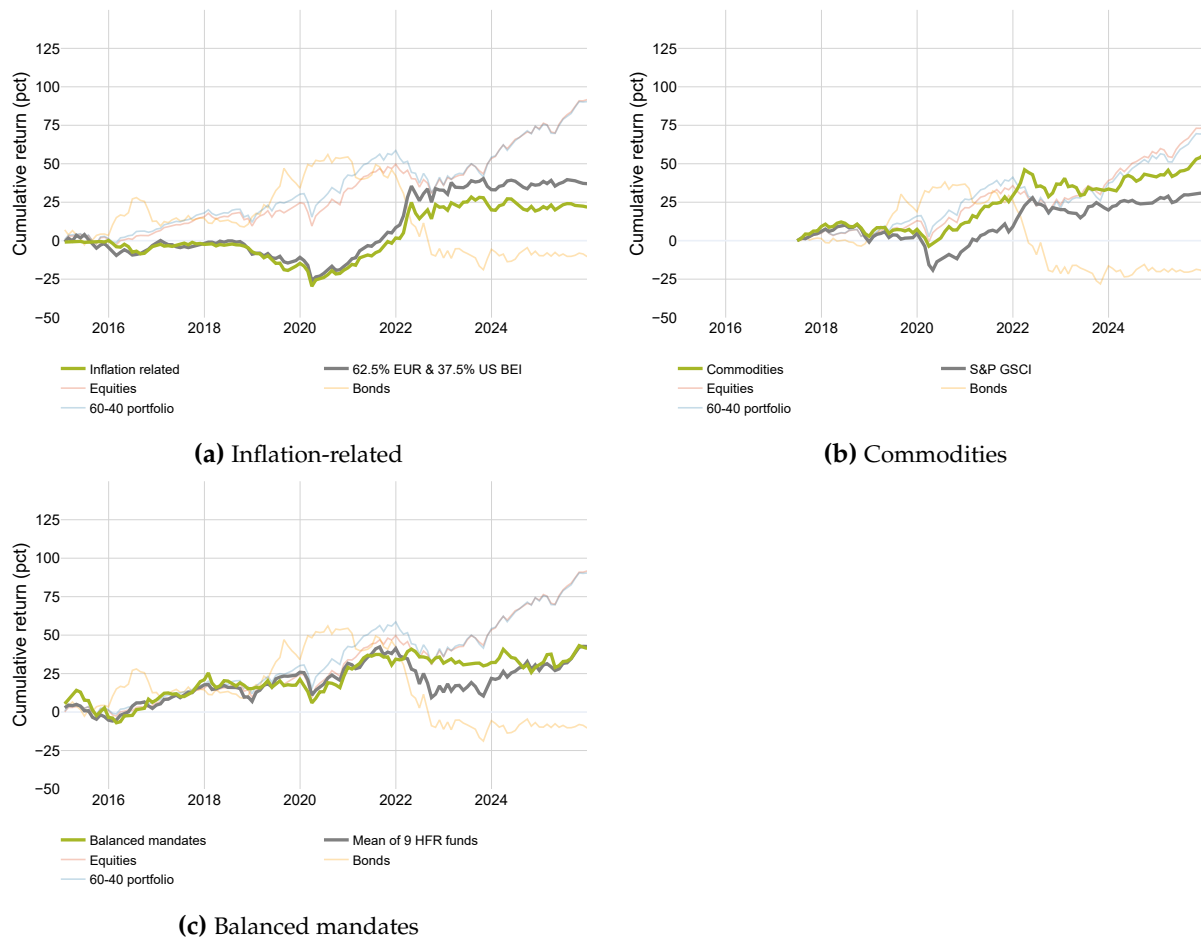


Exhibit 7.35: Cumulative return on Inflation related, Commodities, Balanced mandates, and their references at 10 pct volatility. The figure illustrates the performance of the following asset classes: Inflation-related in Panel (a), Commodities in Panel (b), and Balanced mandates in Panel (c).

Performance across asset classes

Within asset classes, ATP's implementation has been broadly in line with market capitalization-weighted benchmarks, with Sharpe ratios within ± 0.1 of benchmarks for most asset classes. Exhibit 7.36 reports risk-adjusted results across asset classes. The last column reports the ratio of a gross cumulative return over the sample of ATP's return versus the return of reference benchmark for that asset class. Numbers greater than one indicate that ATP has done better than the reference. The strongest relative results are for Danish equities, Public credit, and Commodities, while the weaker results are for Foreign equities, Global fixed income, and Inflation-related assets. Exhibit 7.25 reports the risk share of each asset class at end-2025. The risk share is important because it indicates the largest allocations in the liquid portfolio are to Global equities (at 44 pct) with Foreign equities (35 pct) and Danish equities (9 pct), and Global fixed income (30 pct). These are asset classes where ATP has performance in line with reference (Global equities) or underperformed (Foreign equities and Global fixed income). Thus, the stronger performance in smaller asset classes has not been enough to offset the weaker

performance in equities and fixed income.

Exhibit 7.36: Return statistics for the asset classes in the liquid portfolio when invested at 10 pct target volatility. The table presents return statistics for 10 pct ex-ante target volatility (that is annualized mean return, volatility, and Sharpe ratio for ATP and the reference portfolio benchmark). The average realized excess returns, used to calculate the reported Sharpe ratios, are not reported. The table also presents the ratio of the ATP gross return divided by the reference gross return, with both ATP and the reference invested at 10 pct volatility. Reference indices and end-2025 risk shares are reported in Exhibit 7.25.

Asset class	ATP			Reference			Ratio ATP / Ref.
	Mean return (pct)	Vol. (pct)	Sharpe ratio	Mean return (pct)	Vol. (pct)	Sharpe ratio	
Global equities	6.2	6.9	0.80	6.2	7.5	0.74	1.01
Danish equities	6.4	7.1	0.80	5.7	7.0	0.73	1.08
Foreign equities	4.9	6.8	0.61	6.2	7.5	0.74	0.87
Public credit	6.4	10.0	0.57	4.5	9.0	0.43	1.21
Global fixed income	−1.1	10.0	−0.18	−0.2	12.6	−0.07	0.93
Danish mortgage bonds	−0.3	11.1	−0.10	−1.3	13.1	−0.16	1.12
Inflation-related	2.2	9.9	0.17	3.3	9.1	0.29	0.89
Commodities	5.5	7.5	0.60	3.5	8.6	0.30	1.20
Balanced mandates	3.5	8.6	0.33	3.7	9.2	0.32	0.99

Risk-adjusted performance

ATP's active implementation has generally been positively compensated after controlling for reference-market exposure risk, but not in Foreign equities, Global fixed income, and inflation-related assets. To assess the impact of active risk-taking, Exhibit 7.37 presents results from [Treyner and Black \(1973\)](#) regressions. These regressions are a reference portfolio diagnostic, not alpha tests against formal benchmarks; as Section 7.1 explains, ATP does not operate against formal portfolio benchmarks, so the regressions indicate whether implementation added return relative to reference portfolios after controlling for beta exposure. There are positive appraisal ratios for Global equities, Danish equities, Public credit, Danish mortgage bonds, commodities, and the balanced mandates; the three negative appraisal ratios are for Foreign equities, Global fixed income, and Inflation-related. The *R*-squared values are highest for Danish assets, where there are few ways to obtain the relevant market exposure, and lowest for the balanced mandates, where the underlying hedge funds in the reference portfolio are expected to have larger

deviations from a simple reference index. Commodities also stand out with a lower *R*-squared, reflecting ATP's choice not to hold agricultural commodities.

Exhibit 7.37: Performance regressions for the asset classes in liquid assets, 2015–2025. The table reports estimates from performance regressions based on 10 pct volatility-scaled returns. The estimated alphas are annualized and expressed in percentages. The estimated appraisal ratios are annualized. [White \(1980\)](#) standard errors are reported in parentheses below the estimates of alphas and betas. Reference indices are reported in [Exhibit 7.25](#).

ATP asset class	Alpha	Beta	R-squared	Appraisal ratio
Global equities	0.90 (0.89)	0.84 (0.04)	0.82	0.31
Danish equities	0.69 (0.51)	0.99 (0.02)	0.94	0.40
Foreign equities	−0.69 (0.77)	0.85 (0.03)	0.88	−0.29
Public credit	1.88 (1.23)	1.03 (0.05)	0.84	0.47
Global fixed income	−0.51 (1.49)	0.70 (0.04)	0.75	−0.10
Danish mortgage bonds	0.63 (0.77)	0.83 (0.03)	0.95	0.27
Inflation-related	−0.76 (1.27)	0.89 (0.05)	0.79	−0.18
Commodities	2.96 (1.82)	0.63 (0.07)	0.53	0.57
Balanced mandates	1.03 (2.23)	0.49 (0.07)	0.28	0.14

7.6.5 Illiquid assets

Performance evaluation of illiquid assets

Evaluating the performance of illiquid assets is less straightforward than for liquid assets (as discussed in [Section 4.3.4](#)). We highlight further considerations when evaluating the illiquid assets before discussing the results.

Choosing a liquid comparable alternative to an illiquid asset class is typically harder than for a liquid asset. For example, private equity portfolio companies are typically smaller (even rel-

ative to listed small cap equities) and sector exposures can differ significantly from listed markets; investments in loans without leverage have other risk characteristics than leveraged loans indices available for comparisons; direct domestic investments in real estate without leverage are harder to compare with listed investments in real estate companies. We do, of course, evaluate the performance of ATP's illiquid assets with these caveats in mind.

Smoothed valuations also make short-term comparisons with liquid alternatives harder to interpret. The smoothing of values artificially reduces measured volatility and correlations, making illiquid assets appear more attractive than they are (see Section 4.3.4). Hence, we will not report volatilities and Sharpe ratios based on realized returns.

Volatility-scaled returns require rebalancing to a fixed volatility. In practice, it is hard to allocate a fixed risk budget to an illiquid asset (see Section 4.4.4). To address this, we use a complementary volatility scaling in which the investment in the reference asset is given the same ex-ante risk as the illiquid asset. The reference asset then measures the performance available at the actual risk level in the illiquid asset. This addresses the rebalancing problem but introduces another problem, namely the effect of smoothed valuations (see Section 4.3.4). Smoothing compresses measured volatility in normal times, but at turning points it does the opposite: official valuations adjust slowly, so in a major downturn the illiquid asset's value and measured risks are inflated relative to its true value and risk. As the reference asset is scaled to that inflated risk, its risk budget is raised precisely when markets have fallen and lowered after they recover. The actual risk scaling therefore compares the illiquid asset against a liquid reference that is implicitly running a buy-low-sell-high strategy (increasing risk in downturns and decreasing it in upturns). This may bias the comparison in favor of the liquid reference when prices mean-revert, and we keep it in mind when interpreting the results. We are careful not to emphasize one measure over the other.

We compare illiquid assets with their liquid references both with and without the illiquidity component of ATP's risk model. The illiquidity component signifies a judgement of illiquidity risk contribution and hence the implicit fair return for assuming this risk. The component is captured by the Other factor in the factor representation (see Section 6.3 and Section 6.9.2, especially Exhibit 6.28). When ATP makes an illiquid investment, the existence of the illiquidity component will hence increase the required return on that investment. Besides the market risk charges (listed equity for Private equity; credit spread for Private credit; listed equity, yield curve, inflation curve, and credit spread for Infrastructure; and listed equity, yield curve, and inflation curve for Real estate), ATP models the additional illiquidity charges as sold out-of-the-money put options. This reflects that an illiquid investment that has to be sold during times of high market uncertainty can be expected to fetch a sizeable price discount, and the

premiums earned on the written options are the compensation ATP requires for bearing that risk. Being non-linear, this illiquidity component becomes especially important in simulations and assessments of expected tail losses.

Historically, the estimated illiquidity premiums used for expected return calculations for illiquid assets has been positive, but less than 1 pct. ATP's assumptions for illiquidity are deliberately conservative, in the sense that the premiums are set at the low end: since they also enter ATP's ALM projections, a higher required return on illiquid assets would otherwise make them appear overly attractive. ATP's illiquidity premiums are smaller than those implied by theoretical portfolio choice models comparing optimal allocations with and without illiquid assets, which are reviewed in Section 4.4.4. Those models derive optimal holdings of illiquid assets and compute shadow costs, or certainty equivalents—the excess returns required to compensate the investor for the inability to rebalance illiquid assets—so that the resulting estimates are *utility* costs of illiquidity. ATP's estimates, in contrast, are based on the prices of out-of-the-money put options on liquid securities and hence measure a *market* cost of potentially being forced to sell at a discount in stressed conditions, without accounting for the constrained portfolio dynamics associated with holding illiquid assets. Both the option specifications and the resulting premiums are highly model-dependent. Excluding the illiquidity component leaves a comparison that rests only on the market risk charges, and thus does not depend on how the illiquidity risk itself has been calibrated.

All reported performance figures are net of all fees paid to external managers. Fees can be substantial, especially in illiquid investments, and have a material impact on returns (see Section 4.3.4). Hence, it is important to adjust for this so that all returns are net of fees.

Allocations to illiquid assets

ATP has allocated more than DKK 100 billion to illiquid assets during the period 2015–2025, with 2025 allocations of 38 pct to Private equity, 3 pct to Private credit, 23 pct to Infrastructure, and 36 pct to Real estate. The corresponding absolute risk allocations have been more than DKK 15 billion using ES(99 pct, 3M) with 2025 relative risk allocations of 48 pct to Private equity, 29 pct to Real estate, 17 pct to Infrastructure, and 5 pct to Private credit. Exhibit 7.38 shows how the allocation has evolved over time (due to both allocation changes and value changes). Total allocation over the period started around DKK 97 billion in 2015, then increased and peaked at around DKK 169 billion in 2021, decreased thereafter, and was DKK 117 billion in 2025. The risk allocation shows a similar pattern and was DKK 16 billion in 2025. The decrease in absolute allocations since 2021 has shifted the allocations away from Private credit and Infrastructure in favor of Private equity and Real estate.

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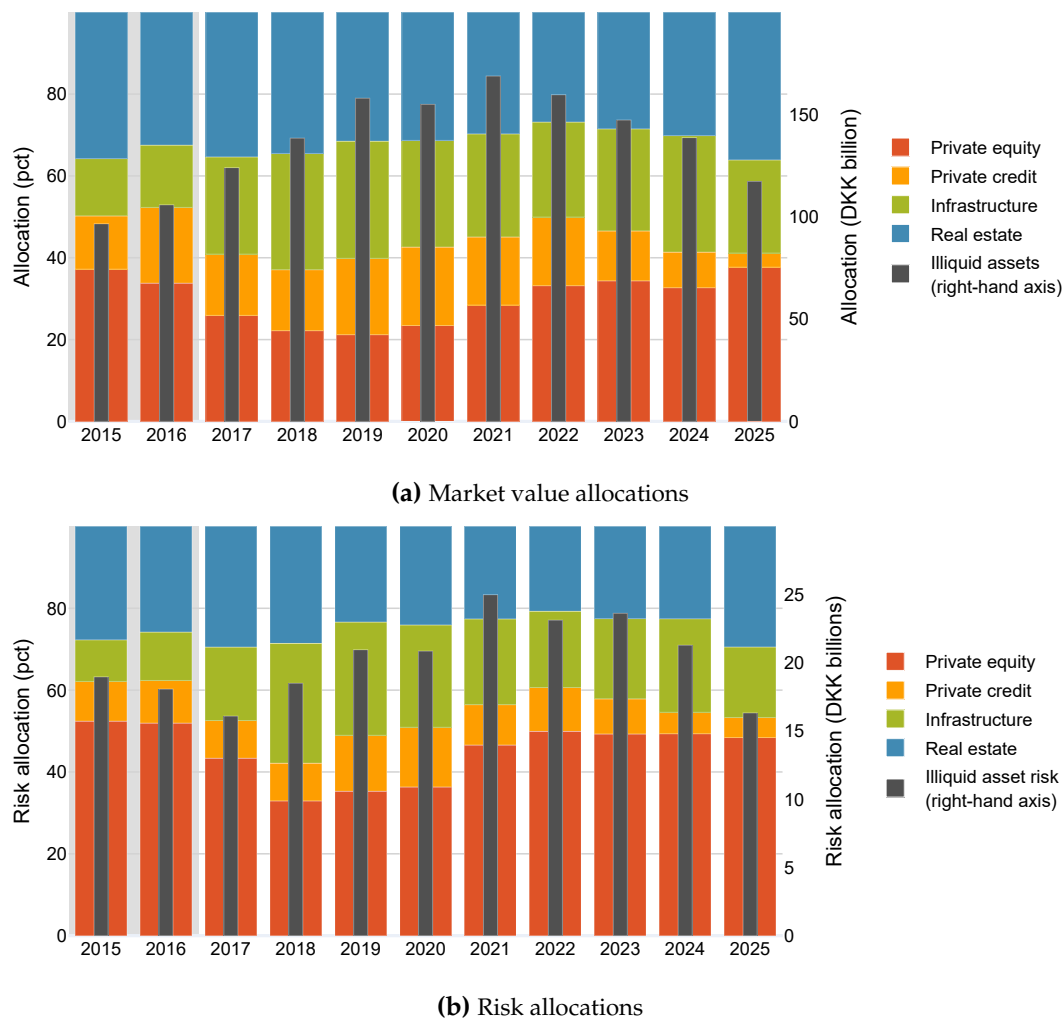


Exhibit 7.38: Absolute and relative allocations into illiquid assets as of end-of-year 2015–2025. Panel (a) shows the market value allocation to the asset classes (with relative allocations on the left-hand axis and absolute allocations in DKK billion on the right-hand axis); Panel (b) shows the risk allocation (with relative risk allocations on the left-hand axis and absolute risk allocations in DKK billion on the right-hand axis).

The illiquid portfolio comprises a mixture of funds and direct deals. Currently, there are around 240 private equity funds plus a few infrastructure funds, with more than 1,600 portfolio companies in ATP's total portfolio, of which the vast majority are managed within the PEP portfolio. The private equity and infrastructure portfolios have 13 direct investments (a reduction in the last five years as part of ATP's ambitions to reduce concentration risk and the size of the illiquid portfolio). The private credit portfolio includes eight funds and no direct investments (they have run off without reinvestments). The real estate portfolio includes 10 funds and around 100 directly owned properties.

Performance with public market equivalents

ATP's illiquid investments have modestly outperformed their liquid references, with a weighted average public market equivalent (PME) of 1.07. The top part of Exhibit 7.39 provides PMEs

for ATP's illiquid assets decomposed into the main asset classes; the middle and bottom parts provide IRRs and TVPIs for completeness. Average PME, IRR, and TVPI have been 1.07, 7.0 pct, and 1.47, respectively. (These aggregates exclude Real estate, for which PMEs and TVPIs are not calculated.)

Across asset classes, Infrastructure and Private equity (including PEP) have average PMEs well above 1.0, indicating solid outperformance of their public market equivalents. Private equity shows the highest average PME of 1.19, with PEP at 1.18, followed by Infrastructure at 1.15. Private credit is the exception, with an average PME of 0.94, indicating underperformance. However, the underperformance of private credit should arguably be interpreted with caution: the reference index includes a large proportion of high yield, whereas ATP's loan positions are typically highly rated and unlevered. Importantly, the PMEs do not include any illiquidity premiums in the reference index.

There is a large dispersion in the PMEs as indicated by the interquartile range (Q3 minus Q1) and the minimums and maximums. The medians of the PMEs are typically lower than the averages, highlighting some investments with very high performance. However, there are also several disappointing investments, especially in Private equity and Infrastructure (that we discuss further below). The last column reports the weighted average excluding the largest deals with an investment size of more than DKK 2 billion. The performance statistics for Infrastructure are mainly affected by the inclusion or exclusion of these investments.

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Exhibit 7.39: Overview of performance statistics for illiquid assets. The table shows PME, IRR and TVPI for the four asset classes at ATP. For Private equity, the PEP portfolio is also carved out. The [Kaplan and Schoar \(2005\)](#) methodology is used for PME measures, using the benchmarks in Exhibit 7.26. IRRs are calculated on realized cash flows and valuations. For Real estate, they are provided by ATP Real Estate and are approximative. Commitments are used to calculate weighted averages. The sample period represents the period where the actual investments have been on ATP's books, starting from the early 2000s.

Asset class	Min	Q1	Median	Q3	Max	Weighted average	Weighted average excl. largest***
PME							
All	0.00	0.84	1.05	1.37	2.96	1.07	1.11
Private equity	0.00	0.76	1.03	1.36	2.96	1.19	1.22
PEP	0.91	1.04	1.15	1.24	1.37	1.18	1.18
Private credit	0.16	0.91	1.01	1.10	1.46	0.94	0.94
Infrastructure	0.23	0.85	1.13	1.52	2.81	1.15	1.41
Real estate*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
IRR							
All	−100.0 pct	3.0 pct	8.1 pct	14.0 pct	85.7 pct	7.0 pct	8.7 pct
Private equity	−100.0 pct	0.5 pct	9.7 pct	15.3 pct	47.4 pct	8.5 pct	11.3 pct
PEP	2.8 pct	10.2 pct	11.5 pct	14.5 pct	16.5 pct	12.7 pct	12.7 pct
Private credit	−66.7 pct	4.4 pct	7.6 pct	11.9 pct	20.6 pct	6.6 pct	6.6 pct
Infrastructure	−45.8 pct	2.3 pct	7.3 pct	13.8 pct	85.7 pct	5.3 pct	9.3 pct
Real estate	−0.2 pct	4.4 pct	5.4 pct	7.9 pct	13.0 pct	5.4 pct	5.4 pct
TVPI							
All	0.00	1.09	1.34	1.81	4.80	1.47	1.53
Private equity	0.00	1.0	1.45	1.94	4.80	1.78	1.83
PEP	1.24	1.41	1.72	1.85	2.32	1.80	1.80
Private credit	0.21	1.11	1.28	1.44	2.14	1.23	1.23
Infrastructure	0.33	1.10	1.41	2.01	3.19	1.48	1.83
Real estate**	N/A	N/A	N/A	N/A	N/A	N/A	N/A

* Real estate PMEs are not calculated as the difference in risk is viewed too large, as ATP's Real estate are unlevered, but the reference (see Exhibit 7.44) is levered (currently an average LTV around 40 pct).

** TVPIs for Real estate are not calculated due to data availability and long holding periods.

*** Weighted average of the statistics when direct investments with commitments above DKK 2 billion are excluded from the average (three deals in Infrastructure and one deal in Private equity).

Performance comparison with risk-scaled returns

ATP's illiquid assets have carried an annualized illiquidity premium over the 60-40 portfolio of less than 1.0 pct. Exhibit 7.40 shows the risk-adjusted performance on ATP's total illiquid portfolio and compares with the liquid references. In Panels (a) and (b) the illiquidity risk charge is taken out of the risk model thus representing a world where the risk in the illiquid portfolio only represents the risk that is generated by the liquid factor representation. Panel (a) uses the fixed 10 pct volatility scaling, while Panel (b) uses the actual volatility scaling to the risk in illiquid assets. In Panels (a) and (b), the illiquid assets have yielded around 0.98 pct and 0.46 pct in annualized average return in excess of the 60-40 portfolio, respectively. In other words, the illiquid assets have carried a positive illiquidity premium over the 60-40 portfolio under both scaling measures.

The illiquidity premium has been similar to the required return implied by the illiquidity risk charge in ATP's own risk model. In Panels (c) and (d), the illiquidity risk charge from ATP's risk model is included. Panels (c) and (d) use fixed 10 pct volatility scaling and risk scaling with realized volatilities, respectively. The illiquid assets have yielded an excess return over their own illiquidity risk requirement under fixed volatility scaling, while the opposite is the case under realized risk scaling (consistent with the observation that the latter scaling is the more conservative of the two). Under both measures, the over/under performance is negligible in magnitude and hence not clearly distinguishable from zero.

ATP's largest investments have contributed negatively to the overall performance. Panels (b) and (d) both show the performance with and without the largest direct investments (four deals exceeding DKK 2 billion in commitments). In line with the performance measures in Exhibit 7.40, the negative impact of the largest deals is evident. It is especially evident in Panel (d), which is the most conservative performance measure.

We emphasize that the evaluations in Panels (a) to (d) each have their challenges related to risk-scaled performance measures of illiquid assets. Hence, they should not be viewed in isolation but rather together with the other measures.

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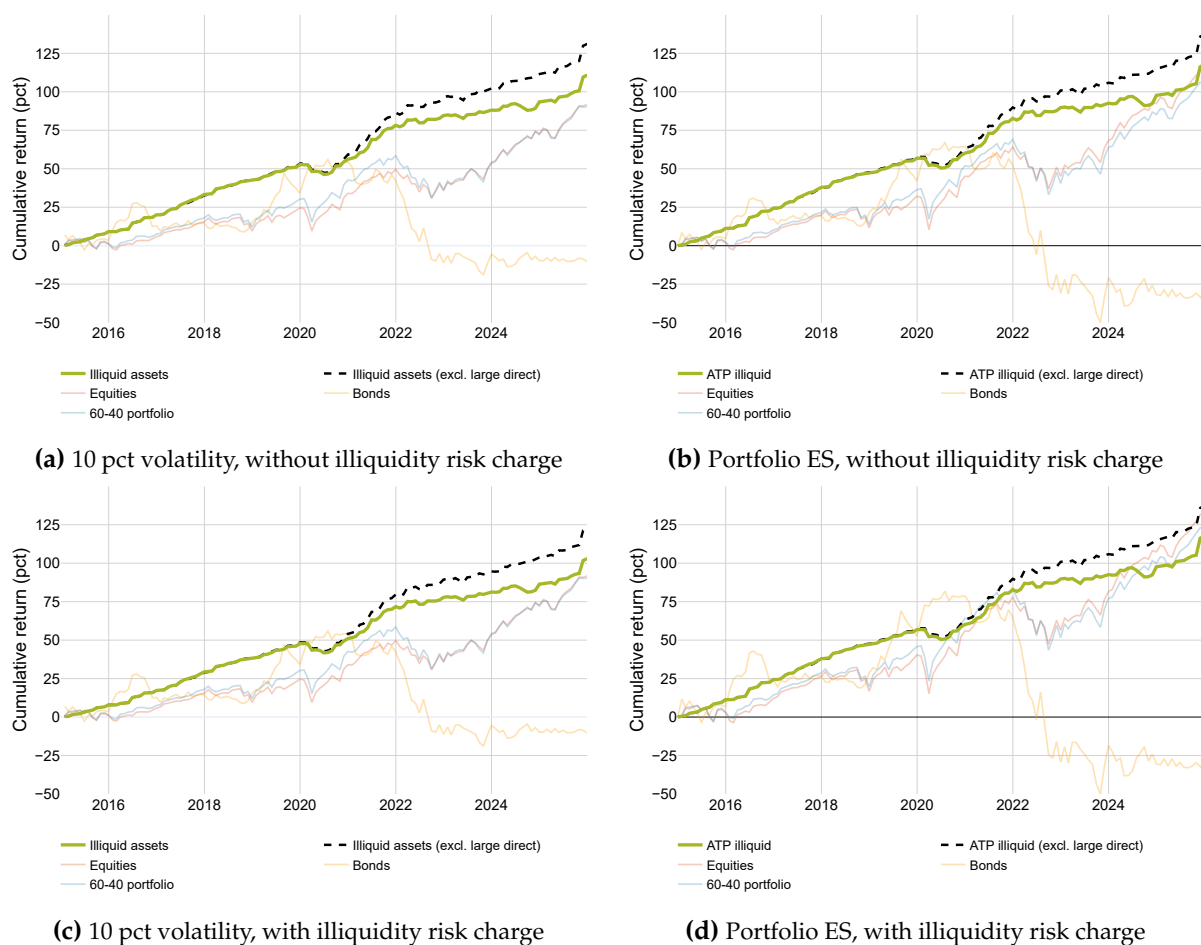


Exhibit 7.40: Cumulative return on total illiquid assets and risk-scaled liquid references. In Panels (a) and (b) the charge for illiquidity risk is excluded; in Panel (a) all assets are scaled to 10 pct volatility while in Panel (b), all assets are scaled to the risk of the actual ATP portfolio. In Panels (c) and (d) the charge for illiquidity risk is included. In Panel (c) all assets are scaled to 10 pct volatility while in Panel (d) all assets are scaled to the risk of the actual ATP portfolio. Panels (b) and (d) scale using Expected Shortfall, ES(99 pct, 3M). A fictitious ATP portfolio that excludes the largest direct investments (four deals, each exceeding DKK 2 billion in commitments) is also included in the figures. The illiquidity risk charge in ATP's risk model is captured in the Other factor. Hence, the risk charge increases the stated risk on any illiquid asset, compared to the risk implied solely by the liquid factors in the model, and thereby increases the required return.

To better understand the performance of ATP's illiquid assets, we also consider the private asset classes separately. In the analysis of the total illiquid portfolio we compare performance to a liquid reference portfolio mainly investing in large-cap equities and bonds. However, the underlying illiquid assets, especially in Private equity, are predominantly small-cap equities. It is well known that large-cap equities have outperformed small-cap equities during the evaluation period. Moreover, amongst large-cap equities, overperformance has been concentrated amongst a few global companies in the tech sector. We use a small-cap reference in our evaluation of private equities.

ATP's private equity portfolio has substantially outperformed small-cap equities. Exhibit 7.41 shows that ATP's private equity portfolio has outperformed a liquid reference consisting of 50

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pct FTSE Russell 2000 and 50 pct STOXX 600.

ATP's private equity portfolio has neutral performance versus global large-cap equities. Although ATP has outperformed the asset-specific reference, it has not been sufficient to outperform global large-cap equities. Recall that the presumed alternative to ATP's private equity portfolio (that is, ATP's own liquid foreign equity portfolio) has markedly underperformed the global market-cap weighted equities reference (see Section 7.6.4). In this sense, ATP's investments in private equity have performed better than the alternative of investing in ATP's foreign equity investments.

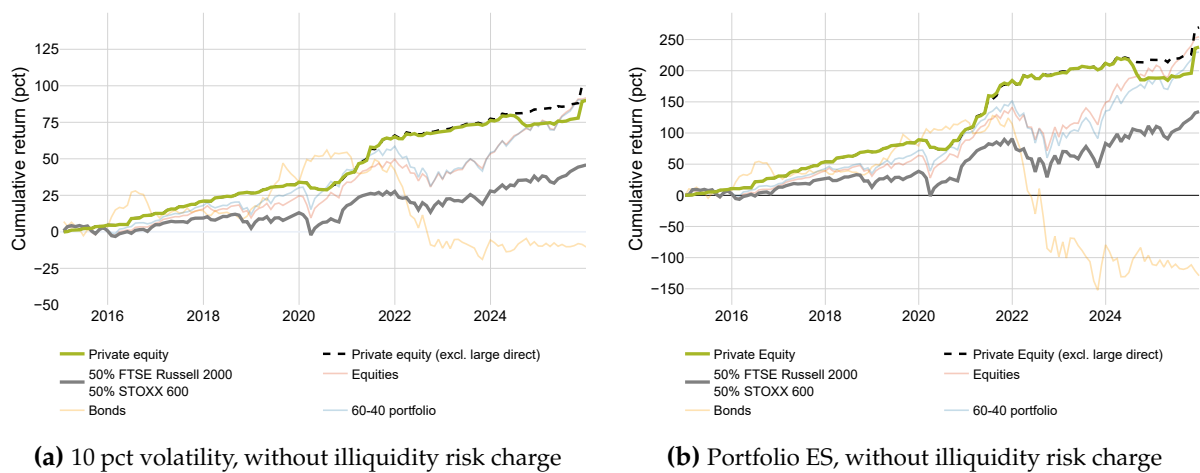


Exhibit 7.41: Cumulative return on Private equity and risk-scaled liquid references. The charge for illiquidity risk is excluded. Panel (a) shows the performance when all assets are scaled to 10 pct volatility; Panel (b) shows the performance when the volatility scaling is done towards risk of the actual ATP portfolio. A hypothetical ATP portfolio that excludes the direct investments exceeding DKK 2 billion in commitments (one deal) is also included.

ATP's credit portfolio has outperformed its asset-specific reference as well as large-cap equities and the 60-40 portfolio. Exhibit 7.42 shows strong outperformance of ATP's credit portfolio versus all references. It seems that the strategy's exposure towards low-risk credit has harvested small, but significant, risk premiums. Recall that ATP's private credit portfolio had a PME of less than one. However, the reference index in that case had lower-rated debt and more leverage.

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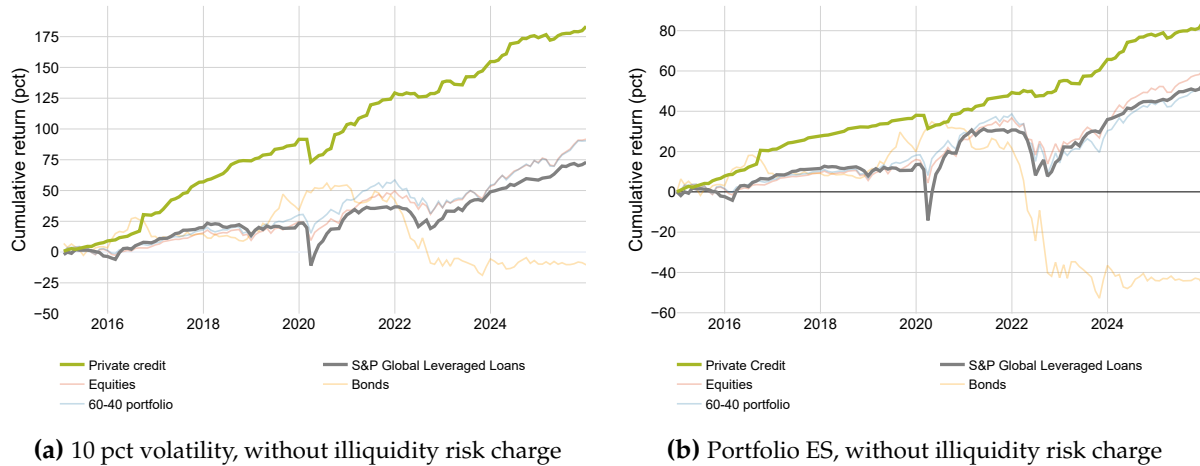


Exhibit 7.42: Cumulative return on Private credit and risk-scaled liquid references. The charge for illiquidity risk is excluded. Panel (a) shows the performance when all assets are scaled to 10 pct volatility; Panel (b) shows the performance when the volatility scaling is done towards risk of the actual ATP portfolio.

ATP's infrastructure portfolio has outperformed its asset-specific reference. Exhibit 7.43 shows that the performance of the infrastructure portfolio has outperformed the asset-specific reference, but the evidence versus the 60-40 portfolio is inconclusive. Again, removing the three large infrastructure deals improves performance significantly, highlighting that the concentrated portfolio has carried substantial idiosyncratic risk that has mattered for the performance.

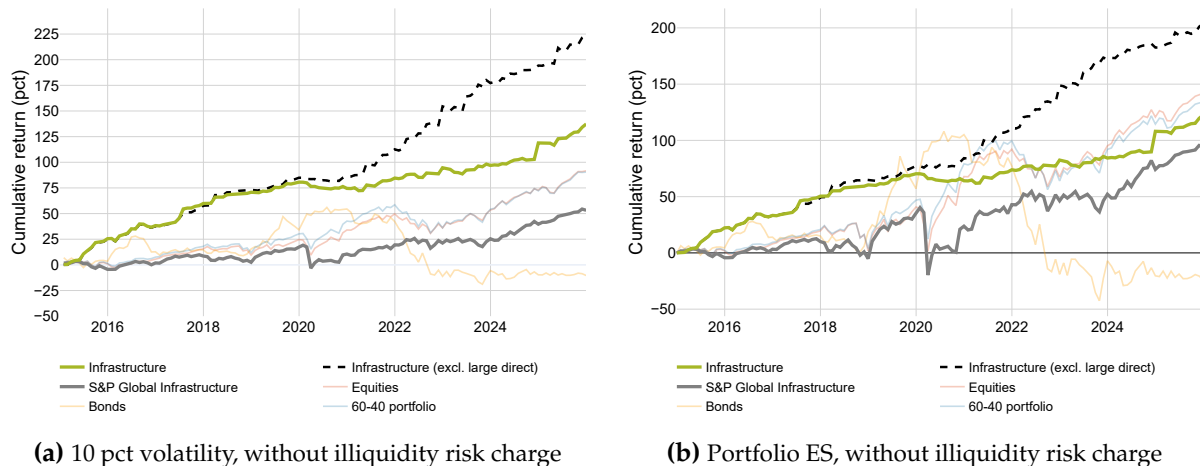


Exhibit 7.43: Cumulative return on Infrastructure and risk-scaled liquid references. The charge for illiquidity risk is excluded. Panel (a) shows the performance when all assets are scaled to 10 pct volatility; Panel (b) shows the performance when the volatility scaling is done towards risk of the actual ATP portfolio. A fictitious ATP portfolio that excludes the direct investments exceeding DKK 2 billion in commitments (three deals) is also included in the figures.

ATP's real estate portfolio has outperformed its asset-specific reference but underperformed global equities and the 60-40 portfolio, as seen in Exhibit 7.44.

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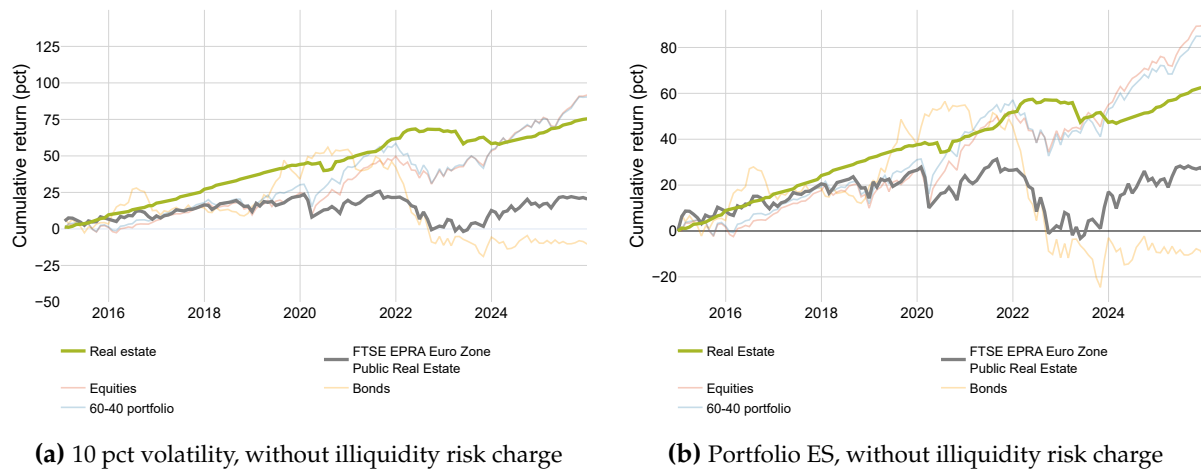


Exhibit 7.44: Cumulative return on Real estate and risk-scaled liquid references. The charge for illiquidity risk is excluded. Panel (a) shows the performance when all assets are scaled to 10 pct volatility; Panel (b) shows the performance when the volatility scaling is done using the risk of the actual ATP portfolio.

We have examined how ATP has been rewarded for investing in illiquid assets compared to allocating the funds or risk budget into liquid alternatives. Next, we examine how the investments compare to other illiquid reference funds.

Performance comparison with other illiquid funds

Comparing ATP's performance on illiquid investments with other funds should be interpreted with some caution. Survivorship and reporting biases in publicized fund manager data are well known potential issues. Also, important parameters for performance comparisons are fund vintage, age (and maturity), size, strategy, and sector focus. The available data source for this report does not enable us to control for such factors, and comparisons with other funds should be interpreted with this caveat in mind. Exhibit 7.45 ranks ATP's realized quarterly IRRs from the first quarter of 2015 to the fourth quarter of 2025 against a comprehensive database of funds' realized IRRs in the same quarters in private equity, private credit, and infrastructure.

ATP's Private equity portfolio has predominantly outperformed the median fund among US and European buyout funds but has rarely found itself in the upper quartile amongst fund managers. Exhibit 7.45 shows that ATP has outperformed a median European and US fund 77 pct and 70 pct of the time, respectively, while ATP has only been in the top quartiles of European and US funds around 10 pct of the time. This suggests that it is difficult for ATP to select funds that are consistently in the top quartile. The data behind the table also show that the average of ATP's quarterly IRRs is higher than the average of the median IRRs of both the European and US reference funds.

ATP's Private credit portfolio has performed slightly worse than the median European credit

fund, bearing in mind that the reference funds arguably are riskier. ATP's private credit portfolio has been above the median and top quartile of European credit funds around 36 pct and 25 pct of the time, respectively. However, the average of ATP's quarterly IRRs is slightly higher than the average of the median IRRs in the credit reference funds.

ATP's Infrastructure portfolio has performed at least on par with the median European reference fund. Over the period, ATP has been above the median European fund 50 pct of the time, while ATP has been in the top quartile around 18 pct of the time. The average of ATP's quarterly IRRs on Infrastructure is higher than the average of the median IRRs of the infrastructure reference funds.

Exhibit 7.45: ATP's IRRs ranked against other funds. The table shows the number of quarters that ATP's IRR is above or below the median or the upper quartile amongst a group of funds in private equity, private credit, and infrastructure. There are 44 quarters covering the period from the first quarter of 2015 to the fourth quarter of 2025. The number of funds in each quarter varies and generally increases over time. The data source is Refinitiv.

	Private equity		Private credit	Infrastructure
	EU	US	EU	EU
	Buyout	Buyout	Credit	Infrastructure
	Median			
# over	34	31	16	22
# under	10	13	28	22
	Upper quartile			
# over	4	4	11	8
# under	40	40	33	36

Taken together, the comparison of ATP with other private equity, private credit, and infrastructure funds suggests that ATP's performance is in line with or above that of a median fund.

Reflections on large deals

Around 60 pct of ATP's illiquid portfolio is managed by the two fully owned subsidiaries, ATP Real Estate and ATP Private Equity Partners, while the remaining part is managed from ATP (either directly or indirectly via managers). This section considers ATP's experiences and lessons learned from the illiquid investments managed internally, where the main part resides in the Global Direct Investments team.

A key element of ATP's investment strategy in recent years has been to reduce the size of the

illiquid portfolio. A large share of the illiquid portfolio was acquired between 2017 and 2019, when there was high investment activity in illiquid assets. Exhibit 7.46 shows that during the three-year period, ATP committed around DKK 45 billion to different investments. Some of the investments were very large. There was a concentration towards Infrastructure, especially Copenhagen Airport, where ATP acquired a 29 pct share of ownership in 2017 for more than DKK 10 billion. Copenhagen Airport was sold to the Danish central government in 2025. In addition, ATP invested in the Danish telecommunication company TDC, which was sold to Macquarie in 2025, with the transaction still awaiting foreign direct investment approval. Other international companies, categorized as Infrastructure, were also bought, and some are still on ATP's books. One international investment, of roughly similar size, was initially a co-investment with an external partner but was transformed into a direct investment when the partner sold its shares. The direct investments mean that ATP handles ownership matters, is represented on the Supervisory Board of the companies, and retains certain legal rights in the ownership agreements.

Exhibit 7.46: ATP's commitments to illiquid investments 2016–2025. The table shows the main commitments in DKK billion each year (the same investment can appear more than once if there were several independent commitments). The actual investments in the companies might differ from the commitments.

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Total commitments, DKK billion	2	23	14	9	6	1	7	<1	4	2
# of deals	2	5	5	5	1	2	5	1	2	4

While several of the illiquid investments have been successful, three large direct infrastructure investments, with Copenhagen Airport and TDC as well-known Danish examples, performed poorly and have caused ATP substantial operational complexity. There is a material difference in performance for ATP's Infrastructure portfolio with and without these three large deals: the average PME for Infrastructure was 1.15 with these investments and 1.41 without them. These three deals constituted 37 pct of the invested capital in Infrastructure.

In the private equity portfolio, a large investment, Northvolt, failed. This asset constituted around 3 pct of invested capital in Private equity and had a marked impact on performance for the total Private equity portfolio, whose reported IRRs with and without Northvolt are 8.5 pct and 11.3 pct, respectively. We return to the lessons learned in the in-depth analysis of illiquid asset capacity in Section 7.7.3.

7.6.6 Summary of assessment

Exhibit 7.47 summarizes our assessments of the investment performance in Section 7.6.2–7.6.5. Panel (a) covers the Interest Rate Hedge Portfolio, Panel (b) the factors, Panel (c) the liquid assets, and Panel (d) the illiquid assets. We also comment on the main evidence behind our assessments and give our main reservations.

Exhibit 7.47: Summary assessment of ATP's investment performance. The table summarizes the evaluations in Section 7.6.2–7.6.5. Panel (a) covers the Interest Rate Hedge Portfolio, Panel (b) the factors, Panel (c) the liquid assets, and Panel (d) the illiquid assets. Returns are scaled to a constant ex-ante volatility as described in Section 7.6.1, references are passive alternatives rather than formal benchmarks, and all illiquid performance figures are net of fees.

Panel (a): Interest Rate Hedge Portfolio (2006–2025)

Portfolio	Overall assessment	Main evidence	Main reservation
Interest Rate Hedge Portfolio	Performed as designed: closely matched the interest rate sensitivity of the guaranteed liabilities.	Annual changes in the value of the Interest Rate Hedge Portfolio (tax-adjusted) track annual changes in the value of guaranteed benefits closely, year by year, since 2006; the large 2022 losses correspond to offsetting reductions in the market value of the liabilities.	Close tracking is non-trivial to sustain: no truly long-dated assets exist, and ATP remains exposed to yield-curve risk at maturities where the discount curve is extrapolated.

Panel (b): Factors (2017–2025)

Factor	Overall assessment	Main evidence	Main reservation
Total factor portfolio	Positive returns of DKK 44 billion but underperformed a 60-40 portfolio on return and risk-adjusted metrics.	At 10 pct ex-ante volatility: 4.0 pct per year and a Sharpe ratio of 0.28 versus 6.8 pct and 0.70 for 60-40; the shortfall is most pronounced over 2020–2025 (Sharpe ratio of 0.07 versus 0.57).	Out-of-sample performance is weaker than the backtests, but factors can underperform for a decade or more, and the evaluation window is short.

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Exhibit 7.47 (continued): Panel (b)

Factor	Overall assessment	Main evidence	Main reservation
Equities	Strongest contributor among the four factors.	Excess returns of DKK 76 billion, benefiting from the broad rise in global equity markets.	Implementation lagged a 60-40 portfolio: the underweight to the US and deviations from market-cap weights were costly when large-cap US equities dominated.
Rates	Disappointed over the evaluation period.	Excess returns of DKK –60 billion; performance was positive until 2022, then suffered a drawdown as interest rates rose.	The shortfall is concentrated in the 2022 rate shock, an unusually adverse episode for duration exposure.
Inflation	Delivered positive returns and proved a valuable diversifier.	Excess returns of DKK 32 billion, with strong performance through the post-2020 inflation shock, validating its selection for diversification properties.	Long-run stand-alone performance is weaker than that of the other factors (Section 7.3.2).
Other	Disappointed relative to the historical evidence.	Excess returns of DKK –4 billion; the factor did not provide diversified positive returns in 2022 when equities and bonds both performed poorly.	ATP's deliberate underweight while phasing in exposure added value given the factor's weak realized performance.

Panel (c): Liquid assets (2015–2025)

Asset class	Overall assessment	Main evidence	Main reservation
Total liquid portfolio	Materially underperformed a 60-40 portfolio.	Sharpe ratio of 0.41 versus 0.68 for 60-40 at 10 pct ex-ante volatility; realized volatility of 10.2 pct was almost exactly on target.	The shortfall reflects ATP's deliberate factor construction (more Rates, less Equity) in a period of strong equities and weak bonds, not weak implementation; ATP led the references before 2022.

Review of ATP's Investment Strategy

Exhibit 7.47 (continued): Panel (c)

Asset class	Overall assessment	Main evidence	Main reservation
Equities	Global equities broadly matched the reference; Danish equities outperformed, Foreign equities underperformed.	Return ratios versus references of $1.01\times$ (Global), $1.08\times$ (Danish), and $0.87\times$ (Foreign); appraisal ratios of 0.31, 0.40, and -0.29 .	The Foreign equities shortfall, the largest single contributor at the asset class level, is the realized cost of deliberate diversification away from the US-dominated benchmark.
Fixed income	Public credit outperformed its reference; Global fixed income and Danish mortgage bonds performed close to theirs.	Public credit return ratio of $1.21\times$ with an annualized alpha of 1.9 pct and an appraisal ratio of 0.47; Global fixed income and Mortgage bonds tracked their references closely.	Part of the Public credit outperformance reflects a broader portfolio construction than the pure high-yield reference; the appraisal ratio for Global fixed income is negative (-0.10).
Commodities and alternatives	Commodities outperformed; balanced mandates were in line; inflation-related assets lagged.	Commodities: return ratio of $1.20\times$, annualized alpha of 3.0 pct, and a smaller 2022 drawdown than the S&P GSCI; Balanced mandates matched the mean of nine multi-asset hedge funds ($0.99\times$).	Inflation-related assets underperformed a reference constructed with 10-year tenors ($0.89\times$; appraisal ratio of -0.18).

Panel (d): Illiquid assets

Asset class	Overall assessment	Main evidence	Main reservation
Total illiquid portfolio	Modestly outperformed liquid references, earning a positive but modest illiquidity premium.	Weighted-average PME of 1.07; annualized premium over the 60-40 portfolio below 1.0 pct (0.98 pct and 0.46 pct using the two risk scalings).	Smoothed valuations and reference choice complicate the comparisons; the premium is similar to the required return implied by ATP's own illiquidity risk charge, and the four largest direct deals detracted from performance.

Review of ATP's Investment Strategy

Exhibit 7.47 (continued): Panel (d)

Asset class	Overall assessment	Main evidence	Main reservation
Private equity	Outperformed its public market equivalent and small-cap references.	PME of 1.19 (PEP: 1.18); substantially outperformed a 50 pct Russell 2000 / 50 pct STOXX 600 reference and beat the median US and European buyout fund.	Performance is neutral against global large-cap equities and above the median reference fund; Northvolt (around 3 pct of invested capital) was a notable failure.
Infrastructure	Outperformed its asset-specific reference.	PME of 1.15, rising to 1.41 when the three largest direct deals are excluded.	Performance hinges on three large, poorly performing direct deals (37 pct of invested capital), and the evidence versus the 60-40 portfolio is inconclusive.
Private credit	Mixed: underperformed its public market equivalent but outperformed risk-scaled references.	PME of 0.94; on a risk-scaled basis the portfolio outperformed its asset-specific reference, large-cap equities, and the 60-40 portfolio by harvesting small but significant low-risk credit premiums.	The PME reference contains a large proportion of high yield, whereas ATP's loans are typically highly rated and unlevered, so the PME arguably understates ATP's performance.
Real estate	Outperformed its asset-specific reference.	Cumulative risk-scaled returns above the asset-specific reference.	Underperformed global equities and the 60-40 portfolio; PMEs and TVPIs are not calculated for Real estate, limiting comparability.

7.7 In-depth analyses

This section provides a set of in-depth analyses on issues that are important in evaluating ATP's investment strategy but are not fully captured by the headline performance analysis in the preceding sections.

7.7.1 Leverage

Key message

We support that ATP continue to use leverage, provided it is accompanied by robust governance, transparent reporting, and clear communication. Given the current ATP product, removing leverage would require accepting a much lower expected return, a lower indexation ambition, concentrating risk in a less diversified portfolio, or a combination of all three. That may be a legitimate product-design choice, but it is outside our mandate and is not a feasible choice to meet pension promises within the existing design.

ATP should report gross leverage, net leverage, and unencumbered cash routinely alongside its Expected Shortfall measures, consistent with the [IOSCO \(2019\)](#) emphasis on using multiple leverage measures. ATP should also disclose risk measures which involve collateral calls the Investment Portfolio is designed to withstand under historical and forward-looking stress scenarios. Finally, ATP should communicate leverage in terms of both AuM and Bonus Potential terms, making clear how much leverage comes from the Interest Rate Hedge Portfolio, how much from the Risk-seeking Portfolios, and how much from implementation choices. These recommendations are not a change in investment strategy; they are conditions for maintaining confidence in a strategy that we view as well-founded but necessarily complex.

Given ATP's current product design, the relevant question is not whether ATP should use leverage, but whether leverage is implemented prudently. Sections [6.4.2](#) and [6.4.3](#) explain why leverage is necessary: the required return implied by ATP's nominal guarantees, indexation ambition above the nominal guarantees, and limited contribution to the Bonus Potential cannot be reached with an unlevered portfolio. Further, Section [4.4.1](#) shows leverage can be desirable when it scales a diversified efficient portfolio rather than simply concentrating risk in equities. However, more leverage is required on a diversified portfolio (the theoretical mean-variance efficient portfolio of Section [4.4.1](#) and ATP's corresponding implementation as a multi-factor portfolio in Section [6.3](#)) than on an all-equity portfolio to reach the target return—and leveraging the diversified portfolio results in lower probabilities of loss than leveraging an all-equity portfolio. We therefore do not view the central issue as whether ATP should use leverage. The relevant issue is whether ATP's leverage is prudently implemented through appropriate instruments and liquidity buffers, and whether the governance and communication practices around leverage are consistent with ATP's role as a Pillar 1 pension institution.

ATP should take leverage

Our assessment is that ATP's leverage has been appropriate, but the assessment is conditional on maintaining the liquidity and governance framework that makes the leverage prudent (see Section 4.5.8 on general governance and Section 6.9.4 on ATP risk management). ATP's leverage is large: at year-end 2025, gross leverage is about 2.4× assets under management and net leverage is about 2.0× assets under management. These levels are relatively high for a general public pension fund, and they are currently the highest in ATP's recent history due to the introduction of the new business model. The story, however, is not simply that ATP borrows money to invest in a risky portfolio; ATP's leverage comes from liability hedging, risk-seeking exposures, and the decision to implement diversified exposures through derivatives rather than through a concentrated cash-equity portfolio. Moreover, the ability to employ leverage at low cost is itself a comparative advantage that follows from the non-withdrawable design and stable capital of the ATP product, which other institutions do not have. We agree with ATP's investment belief that this advantage should be used (Sections 6.1).

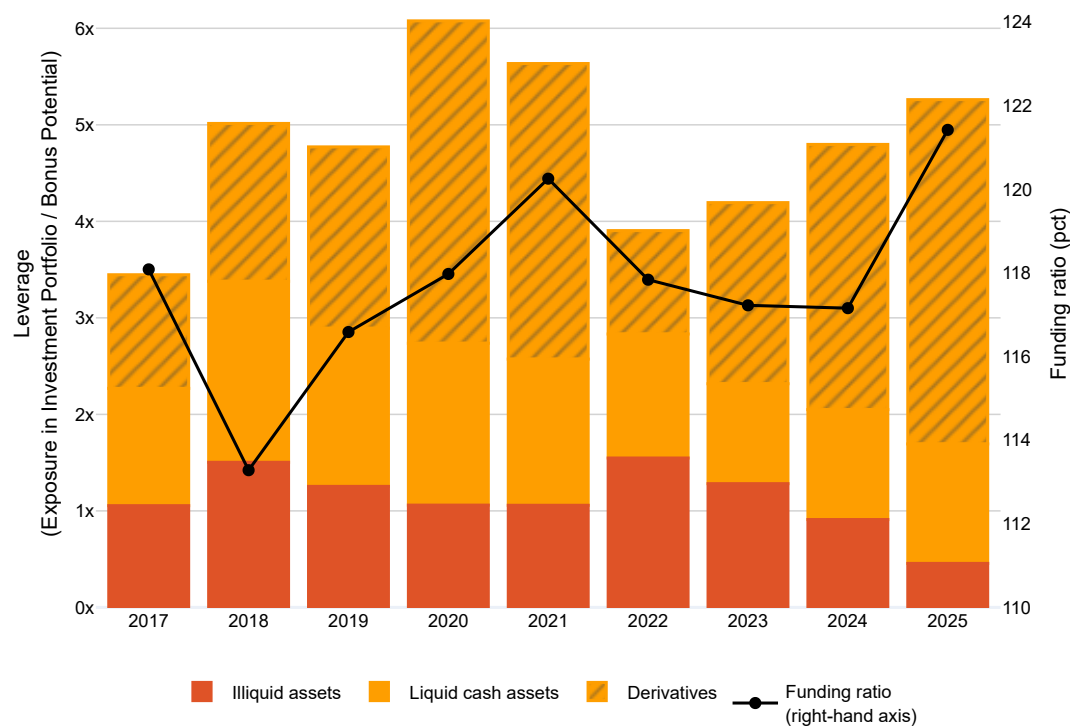
Assessment of leverage versus assets

ATP's leverage arises from several parts of the balance sheet rather than solely from the Investment Portfolio, and, for this reason, leverage should be assessed on a total balance-sheet basis rather than by looking only at the Investment Portfolio. Section 6.6 (Exhibits 6.19 and 6.20) shows that leverage is distributed across ATP's full balance sheet. The Interest Rate Hedge Portfolio contains negative swap exposure and positive bond exposure, reflecting the use of swaps and bonds to hedge guaranteed benefits. The Risk-seeking Portfolios add exposure through illiquid assets, liquid cash assets, and liquid derivatives. Treasury assets include more derivative positions, and the Treasury Portfolio and the Interest Rate Hedge Portfolio provide the funding and collateral resources needed to support liquidity and leverage across the institution. This structure is economically different from borrowing cash to buy more risky assets: it is a balance sheet implementation of hedging, risk-taking, and cash management.

Review of ATP's Investment Strategy



(a) Total leverage on the balance sheet



(b) Leverage on the Investment Portfolio relative to the Bonus Potential

Exhibit 7.48: Leverage on total balance sheet and Investment Portfolio. Panel (a) illustrates the total leverage on the balance sheet, and Panel (b) illustrates the leverage on the Investment Portfolio relative to the Bonus Potential.

At the same time, leverage should also be assessed relative to the Bonus Potential, because this

is the portfolio where investment losses are absorbed first. A household mortgage provides a useful analogy. The loan-to-value ratio is naturally assessed against the full value of the house, because the house is the asset financed by the loan. But the homeowner also cares about the down payment and accumulated principal, because a decline in house prices reduces the homeowner's equity. Similarly, ATP's leverage should be assessed against the full balance sheet because the exposures arise across the full balance sheet, but losses on the risk-seeking positions first reduce the Bonus Potential. A prudent assessment therefore needs both perspectives: total balance sheet leverage to understand the scale and funding of exposures, and leverage relative to the Bonus Potential to understand where losses are first borne.

Leverage looks different depending on the denominator—full balance sheet or Bonus Potential—against which it is measured. Exhibit 7.48 presents both the view of leverage relative to the full balance sheet and relative to the Bonus Potential.⁸⁹ Panel (a) shows the gross and net leverage measured against assets under management—the loan-to-value ratio in the housing analogy—moving in the 1.2× to 1.7× range across 2017 to 2025. Panel (b) shows the leverage expressed as multiples of the Bonus Potential—effectively the homeowner-equity ratio—which is materially higher and considerably more variable: gross exposure has run between approximately 3.9 and 6.1 times the Bonus Potential over the same period. Both leverage on the balance sheet and leverage on the Investment Portfolio increase during Covid in 2020 as liquid markets fall. However, they move in opposite directions in 2022: leverage relative to the Bonus Potential falls as ATP derisks (in line with the CPPI-like dynamic described in Sections 4.1 and 6.6); as the illiquid positions cannot be divested, ATP's derivatives positions sharply contract to facilitate the de-risking. Since 2022, leverage on the full balance sheet and on the Investment Portfolio have increased as ATP implements its new business model (Section 7.7.6) and the Bonus Potential increased.

Implementation of leverage

Although leverage measured relative to the Bonus Potential is high, it should not be interpreted mechanically as excessive: the assessment must also consider how the leverage is implemented, the liquidity resources supporting it, and the expected losses or tail losses that the leveraged positions could impose on the Bonus Potential. Section 6.6.3 discusses that ATP's leverage is implemented largely through liquid derivatives, collateralized swaps, futures, and internal balance-sheet funding rather than through short-term borrowing or forced reliance on external credit lines. This form of leverage separates market exposure from cash financing and leaves Treasury assets available to meet collateral and liquidity needs. A particularly relevant leverage is thus unencumbered cash, which allows ATP to meet margin calls, rebalance expo-

⁸⁹Exhibit 7.48, Panel (a) is the same as Exhibit 7.22 and Panel (b) is the same as Exhibit 7.24 with the inclusion of the funding ratio—these figures are repeated for ease of discussion.

asures, and maintain hedges under stress without forced asset sales. Section 7.5.3 shows that unencumbered cash has never declined below 10 pct, even during periods where leverage has increased. Also, the amount of risk, and thus liquidity needs for meeting collateral calls on derivatives, increases as ATP gets wealthier. Thus, ATP has right-way-risk, as ATP can choose to lower risk to preserve liquidity buffers.

ATP's leverage requires a professional treasury and risk-management function, and the demonstrated quality of this team plays an important role in our positive assessment. First, the implementation of leverage by ATP lowers certain types of risk. Section 6.5 explains that ATP relies mainly on swaps, futures, forwards, and internal balance-sheet funding rather than structural short-term borrowing. This is an important distinction. Derivatives create margin and collateral risk, but they avoid refinancing risk from external debt and allow ATP to hold Treasury assets that can be mobilized in stress. However, derivative-based leverage is operationally demanding: it requires daily collateral management, counterparty controls, liquidity forecasting, stress testing, and the ability to reduce exposures if the Bonus Potential falls. The Covid shock in 2020 and the interest rate shock in 2022 were real-world tests of liquidity and collateral management. The fact that ATP did not experience forced deleveraging in these episodes supports the view that the operational implementation has been excellent, but it does not make the risk disappear. Our positive assessment is therefore conditional on the continuation of this operational standard.

Leverage over time

ATP's leverage has increased since 2022, reflecting a Supervisory Board decision to use the additional risk capacity created by the new business model to pursue ATP's return and indexation objectives. All else equal, the introduction of the Market Return Portfolio and the Supplementary Hedge Portfolio lowers the required return for ATP to meet its inflation ambitions (see Section 6.4.1). Section 7.5.3 shows that gross (net) leverage increases from $1.8\times$ to $2.4\times$ ($1.4\times$ to $2.0\times$) over 2022 to 2025. The revised allocation of risk across the balance sheet created the capacity to take more diversified risk-seeking exposure. It also made greater use of derivatives and treasury funding within ATP's implementation framework. But the new business model did not require leverage to rise all the way to its current level. The higher leverage reflects a Supervisory Board decision to use the available risk capacity to pursue the return and indexation objectives of the product, rather than to run the new structure at a lower level of risk.

This deliberate increase in risk-taking which is above the level required to reach the required return for the inflation ambition matters for our assessment because discretionary increases in leverage require active governance, not only technical implementation. The rise in gross and net leverage after 2022 is consistent with ATP's CPPI-like framework, in which higher

funding ratios and a larger Bonus Potential allow more risk to be taken. At the same time, the Supervisory Board could have chosen a lower risk target, a lower-leveraged implementation, or a slower phase-in of the new portfolios. We therefore view the increase in leverage as a strategic choice made within the new business model, not simply as an unavoidable byproduct of it. That choice is defensible because liquidity buffers remained positive, risk was phased in, and ATP retains the ability to reduce exposure if the Bonus Potential weakened; but leverage should remain a central object of Supervisory Board oversight.

Other risks of leverage

ATP's operational capacity does not eliminate the peer and communication risks created by leverage. ATP has world-class operations to handle the liquidity, operational, and risk-management demands of leverage. Peer and communication risk are different in kind, because they turn on external judgment rather than internal capability.

Peer risk arises because a leveraged, diversified portfolio can underperform simpler all-equity or 60-40 portfolios for long periods. Even if the leveraged strategy is unconditionally efficient, stakeholders may benchmark it against peers with simpler portfolios and conclude that leverage itself is the problem—a risk amplified by ATP's broad public visibility.

Communication risk arises because the figures that describe leverage are easily misread For example, gross leverage and notional exposure can be mistaken for economic loss exposure, and leverage measured against the total balance sheet is not the same as leverage measured against the Bonus Potential, though each comparison is appropriate in a different context. Both risks stem from the same source—leverage being judged on appearances rather than on its economic substance—so ATP needs to explain leverage in terms that distinguish its sources, purposes, and loss-absorbing capacity: leverage used to hedge guaranteed benefits differs from leverage used to obtain risk-seeking exposure; gross exposure differs from expected loss; and total balance sheet leverage differs from leverage relative to the Bonus Potential. We comment further on communication strategy in Chapter 9.

7.7.2 Danish equities

Key message

ATP maintains a deliberate home bias in Danish equities and its performance has been strong. ATP holds DKK 36 billion in Danish equities, 5.2 pct of AuM and 9.6 pct of the risk in the Risk-seeking Portfolios, far above Denmark's 0.42 pct weight in the global market though only modestly above the 4.3 pct held by Danish pension fund peers. The portfolio returned 12.2 pct per year from 2015 to 2025, with positive alphas over both

Key message (continued)

Danish and global market indices. This reflects two active decisions: the overweight itself, and security selection within the Danish market, where ATP plausibly holds a comparative advantage through its knowledge of and engagement with Danish companies. The bias has declined over time as ATP has reduced its risk mandate in Danish equities.

The investment approach is distinctive within ATP—fundamental, bottom-up, and relationship-driven, with active stewardship, in contrast to the quantitative, top-down methods used elsewhere in the portfolio. ATP's role in the Danish market is also widely seen as constructive. Such non-financial benefits—commercial ties for ATP and support for the Danish capital market—are part of ATP's rationale, but the central question is whether the financial case supports the size of the position.

Strong past performance and a plausible comparative advantage are necessary, but not sufficient, to justify a structural overweight of this size. We evaluate the home bias along six dimensions and find a real, but conditional, case for overweighting Danish equities. Realized risk-adjusted returns have been very high, the allocation diversifies total portfolio risk and provides some balanced sector exposure, and direct exposure to the Danish economy is limited because the portfolio companies are globalized—yet none of these is sufficient on its own. Much of the historical outperformance, moreover, reflects the Danish market beating the global market rather than ATP's own skill: a 2.2 pct annual alpha of the Danish index over the global index, a feature of the market that is unlikely to persist. ATP's own selection advantage over the Danish index is smaller, about 1.2 pct per year, and this is the edge on which the position must rest.

Against this, the position concentrates a specific Danish country risk—an isolated 30 pct shock to Danish equities currently reduces the bonus ratio by about 1.3 percentage points—and the small, semi-liquid Danish market is harder to exit in a downturn, as 2022 showed, when Danish equities made up roughly half of liquid equity exposure. A home bias is common among institutional investors, but its mere prevalence is no argument for an outsized position. Justifying the overweight going forward requires evidence that ATP's selection advantage will persist, not merely that it has existed. Without continued outperformance over the Danish index, the extent of ATP's overweight is difficult to justify on financial grounds alone.

ATP's investments in Danish equities

ATP has a significant home bias. Exhibit 7.49 reports key statistics of ATP's investments in Danish equities as of December 31, 2025. ATP's investments in the Danish public equity market amounts to DKK 33 billion (including Private equity it amounts to DKK 36 billion). This corresponds to a share of ATP's AuM of 4.8 pct (5.2 pct). The shares of the equity and Risk-seeking Portfolios are 14.4 pct and 8.7 pct, respectively (15.9 pct and 9.6 pct, respectively). This implies a significant home bias; for example, the Danish equity market share of the MSCI ACWI is only 0.42 pct. The home bias is deliberate and motivated by ATP's comparative advantages. The exhibit reports that the Danish equities share of AuM in the Danish pensions sector is 3.3 pct (4.3 pct), lower but not markedly different from ATP's share.

Exhibit 7.49: Overview of ATP's Danish equity investments as of December 2025. The table reports key statistics of ATP's equity investments. Source: Insurance and Pension Denmark (Forsikring & Pension), statistical overview database. This database does not include ATP.

Metric	Value
Market value*	DKK 33 billion [DKK 36 billion]
Share of AuM* (pct)	4.8 [5.2]
Risk share of equity portfolio* (pct)	14.4 [15.9]
Risk share of Risk-seeking portfolios* (pct)	8.7 [9.6]
Share of Danish equity market (pct)	0.64
Danish equity market share of MSCI ACWI (pct)	0.42
Danish equities share of AuM in Danish pensions sector* (pct)	3.3 [4.3]
Danish equities share of equity portfolio in Danish pensions sector* (pct)	7.8 [9.0]

* Numbers in brackets include Private equity.

Below we evaluate different dimensions of ATP's home bias.

ATP has been a significant investor in the Danish equity market. However, ATP's share of the Danish equity market has decreased from 7 pct in 1999 to less than 1 pct since 2022 and 0.42 pct in 2025. Relatedly, the Danish pension sector has decreased their share of the Danish equity market from 14 pct to less than 3 pct today (not tabulated).

Today, the investment in Danish equities is 5.2 pct of AuM. Exhibit 7.50 shows the development over time of ATP's investments in Danish equities expressed as a share of AuM. The portfolio of Danish listed equities (green line) has fluctuated in the range 3–5 pct since 2015. The portfolio of Danish equities including Private equity (red line) has increased the equity exposure since 2022. In addition to public and private equities, ATP has further equity-like investments categorized

as Infrastructure.

More specifically, TDC and Copenhagen Airport were held as “stable assets” belonging to a portfolio designed to mimic the long-dated liabilities (see Section 5.5) over the period 2018–2025. During this period, the share depicted below was around 1–2 percentage points higher and hence, ATP had large concentration risk in those singular investments. The infrastructure investments are not included in the analysis below since they are not part of the strategy towards Danish equities.

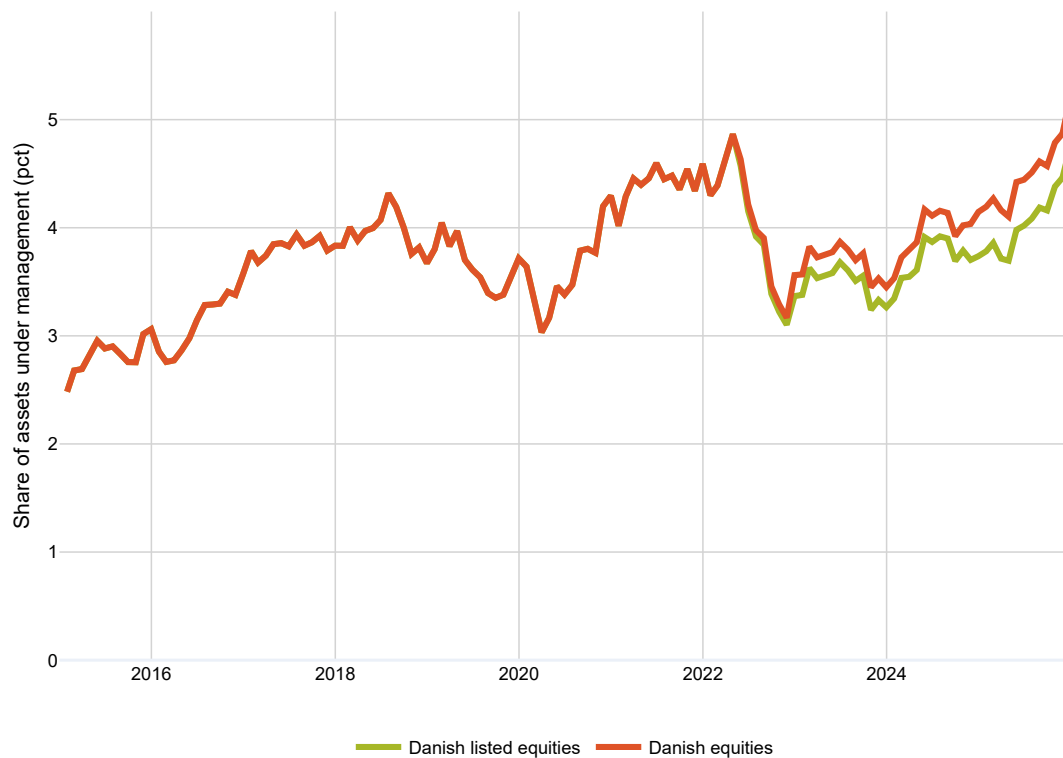
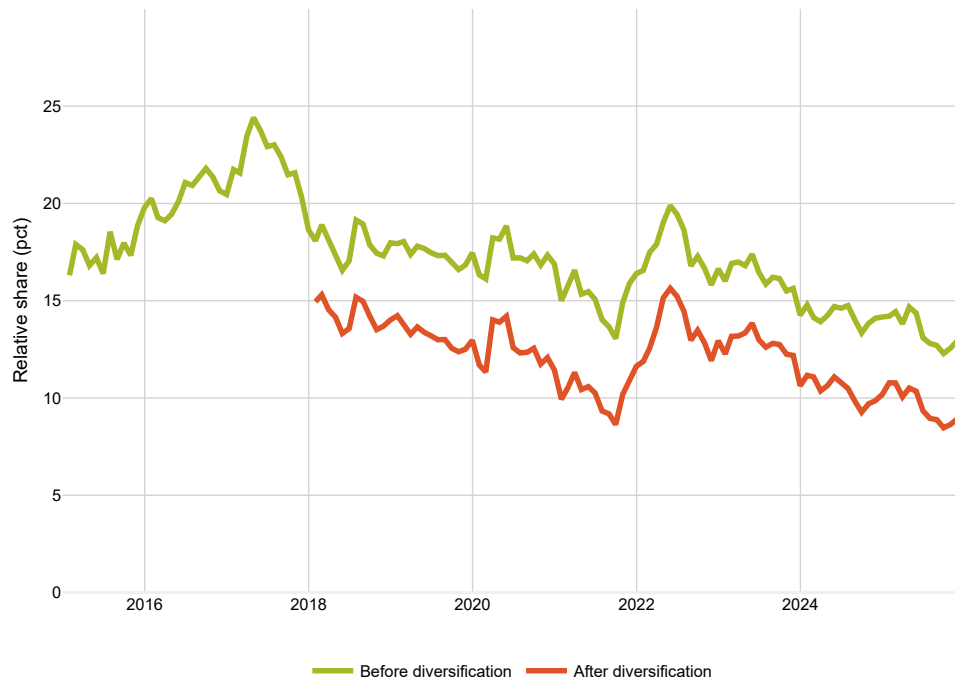
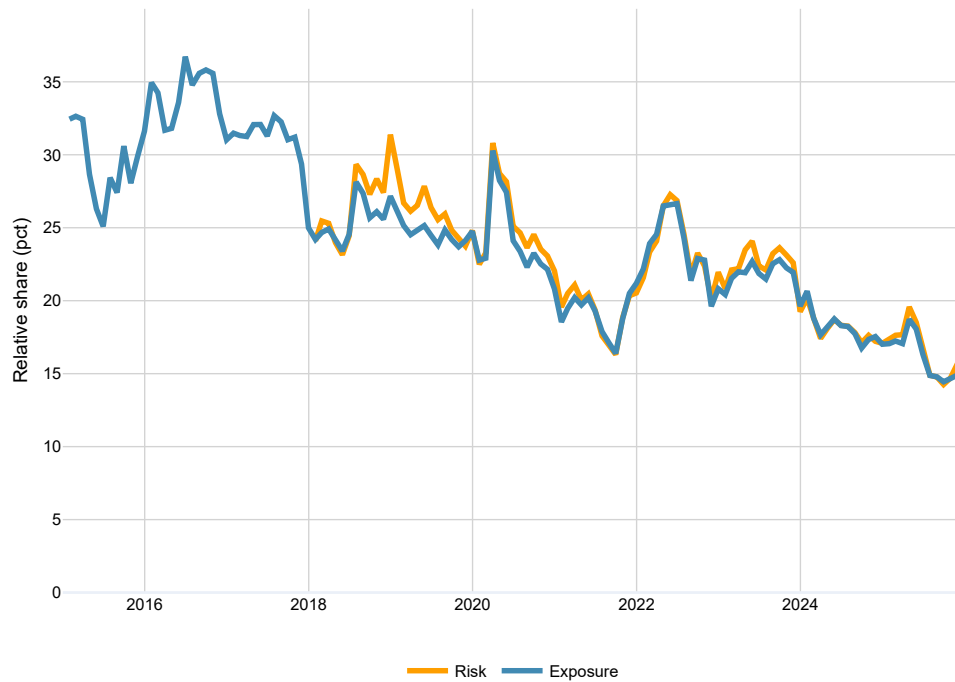


Exhibit 7.50: Market value developments of ATP Danish equity investments. The green line shows Danish listed equities, as a share of AuM. The red line shows Danish equities, including Danish private equity, as a share of AuM.

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(a) Risk relative to Risk-seeking Portfolios



(b) Risk relative to total equity portfolio

Exhibit 7.51: Risk in Danish equities relative to the Risk-seeking Portfolios and the equity portfolio. The figure shows the risk in the Danish equity portfolio (public and private, excluding large single infrastructure deals) relative to the Risk-seeking Portfolios, Panel (a), and the equity portfolio, Panel (b). The green line in Panel (a) shows the relative risk before diversification; the red line shows the relative risk after diversification. The blue line in Panel (b) shows exposure relative to total equities portfolio, while the orange line shows risk relative total diversified equities risk.

ATP has decreased its exposure to Danish equities. Panel (a) of Exhibit 7.51 reports ATP's risk exposure to Danish equities relative to the risk exposure in the Risk-seeking Portfolios, with and without diversification effects. The risk allocation to Danish equities was at its highest during 2018, after which the allocation has gradually decreased as part of ATP's strategy to reduce allocations to listed Danish equities. The risk allocation at year end-2025 is 9.6 pct. Panel (b) of Exhibit 7.51b shows ATP's risk on Danish equities relative to the equity portfolio, which has also decreased over the sample period and is 15.9 pct today. Both exhibits show downward trends, but also variations in the risk allocation. These variations arise to a large degree from the fact that ATP's approach to Danish equities differs from the approach to Foreign equities, where risk is continuously adjusted in accordance with fluctuations in the Bonus Potential. Hence, the resulting relative allocation to Danish equities varies over time.

Strategy and risk mandate

The large allocation to Danish equities is part of ATP's investment strategy. ATP maintains a home bias in Danish equities for three main reasons:

- The strategy on Danish equities delivers attractive return-risk properties, which has manifested itself historically on ATP's portfolio compared to the Danish market portfolio and in turn Danish equity market compared to global equity markets.⁹⁰
- There are commercial benefits to ATP, where dedicated focus and resources to Danish equities provides long standing relationships with the Danish corporate sector, related partnerships with the institutional sector as well as a presence in the media.
- It is viewed as beneficial for the Danish capital market to have a committed institutional investor like ATP participating in IPOs and capital increases, contributing to increased efficiency and market discipline via active positioning. ATP is an active responsible investor with a positive impact focus and a public voice advocating for improved financial market conditions in Denmark.

The investment strategy of Danish equities differs markedly from other investment departments at ATP. Exhibit 7.52 summarizes the investment strategy in the Danish equity team. It is a fundamental, bottom-up, and relationship-driven approach and differs markedly from other investment departments, such as liquid markets, which have more quantitative, top-down, and risk-based approaches. ATP believes that the chosen approach can give the attractive return properties that justify a home bias in the relatively small, niche Danish stock market.

⁹⁰ATP has analyzed data dating back to 1973, confirming that the Danish stock market has performed well; for example, it has delivered the highest excess return amongst the main European, North American, and Japanese stocks markets.

Exhibit 7.52: The investment strategy in the Danish equity investment team.

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- Objective is to obtain a positive long term excess return over the benchmark.
 - Benchmark is KAX CAP, signifying that portfolio construction leans heavily towards equal weights.
 - Fundamental, bottom-up & relationship driven.
 - Long-term investment strategy, but with an ongoing active management of the portfolio.
 - Closely integrating active ownership as well as ESG into the investment process.
 - Benefitting from close relationship with the portfolio companies through long term ownership and position in the Danish equity market.
 - Broadly based team with long-term experience in the Danish equity market.
-

ATP argues that the chosen approach for Danish equities functions better with a more constant risk allocation, compared to the overall dynamic risk allocation that is applied in the Risk-seeking Portfolios. The risk limits to the mandate are thus fixed limits, that are adjusted on a discretionary basis. The current risk targets for Danish equities are lower, compared to the historical size of the portfolio.

Evaluation of home bias

To evaluate ATP's home bias, we consider six dimensions of ATP's investments in Danish equities: 1) historical performance, 2) incremental risk on the Investment Portfolio, 3) sector exposure, 4) exposure to Danish economy, 5) embedded dynamic risk share, and 6) concentration risk.

Historical performance

The return on ATP's investments in Danish equities has on average been around 2 pct higher than the return on Danish and world stock markets. Exhibit 7.53 reports summary statistics of ATP's Danish equities, the global equities benchmark (MSCI ACWI), and the Danish equities benchmark (KAX CAP index). Exhibit 7.54 shows the cumulative returns since 2015. ATP's investments in Danish equities have generated the highest arithmetic annual return of 12.8 pct versus 10.5 pct and 10.6 pct for the Global and Danish indices, respectively. However, ATP has also a higher annualized volatility of 15.9 pct versus 13.2 pct and 14.1 pct for the global and Danish indices. ATP has also earned a higher Sharpe ratio in its Danish equities investments at 0.76 compared to the global and Danish equity benchmarks

Exhibit 7.53: Return statistics for ATP Danish equities, Global equities, and Danish equities from 2015–2025. The table shows the annualized mean return, the annualized realized volatility, and the annualized Sharpe ratio for ATP's Danish equities, a global equity index (MSCI World ACWI), and a Danish equity index (KAX CAP index).

Portfolios	Arithmetic mean return (pct)	Realized volatility (pct)	Sharpe ratio
ATP Danish equities	12.8	15.9	0.76
Global equity index	10.5	13.2	0.74
Danish equity index	10.6	14.1	0.71

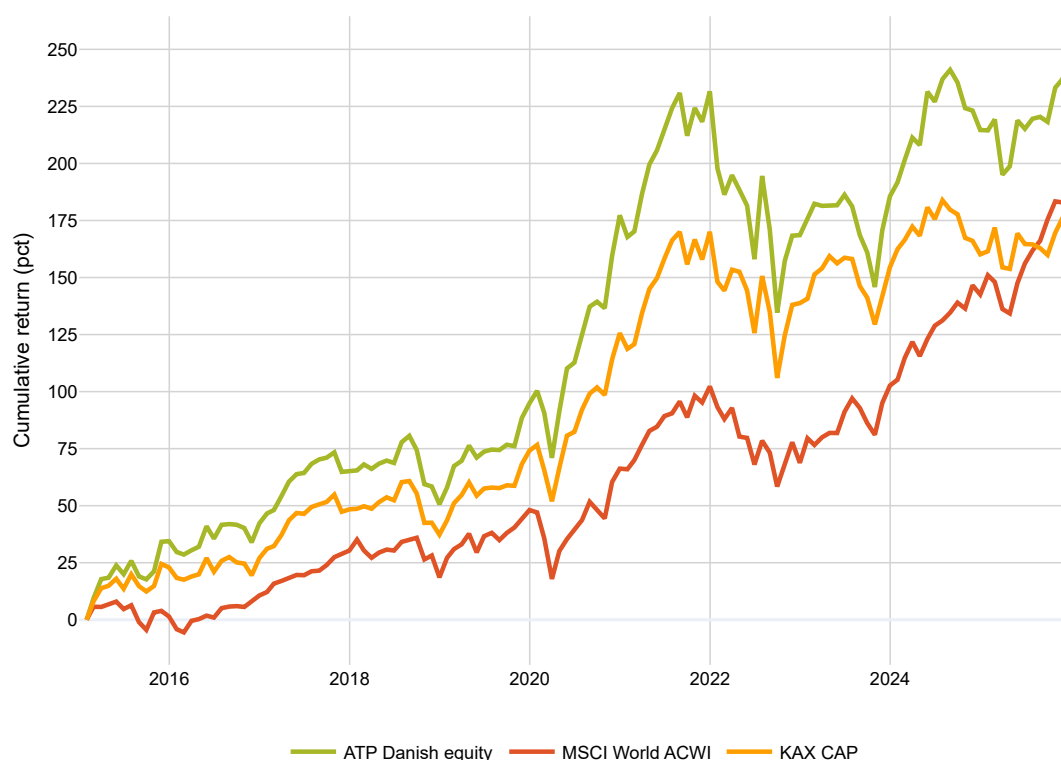


Exhibit 7.54: Cumulative returns on ATP's investments in Danish equities, a global equity index (MSCI World ACWI), and a Danish equity index (KAX CAP). The figure shows the percentage return for a notional-based investor since 2015.

The value added on ATP's investments in Danish equities amounts to DKK 5 billion more in profits than reasonable alternatives. Exhibit 7.55 illustrates a counterfactual calculation, where at the beginning of every month, the market value that ATP invested in Danish equities was invested in the global and Danish indices instead. In both cases, ATP's Danish investments have generated approximately DKK 5 billion more in profits than the alternatives.

Review of ATP's Investment Strategy

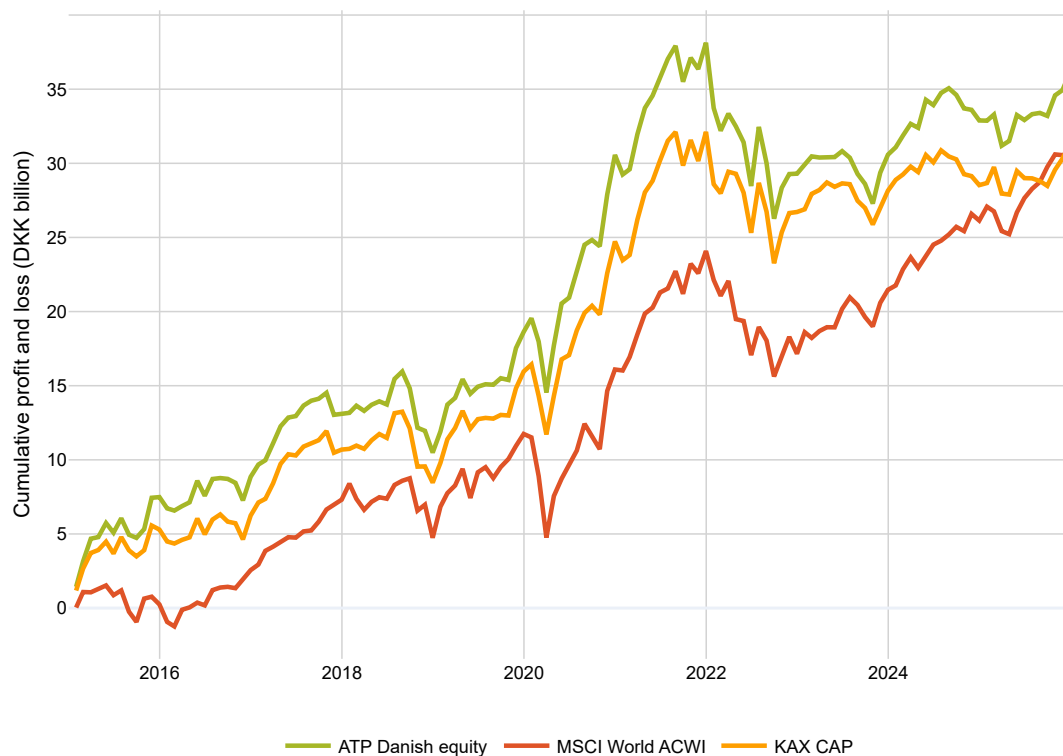


Exhibit 7.55: Cumulative profit and losses on ATP's investments in Danish equities, a global equity index (MSCI World ACWI), and a Danish equity index (KAX CAP). The figure shows the cumulative absolute profit and loss, if at a given month ATP's investment in Danish equities were invested in a global equity index or a Danish index.

We evaluate ATP's Danish equities investments correcting for risk. We run standard performance regressions with excess returns on ATP's investment in Danish equities and the global and Danish market indices to correct for beta exposures. We then also compute appraisal ratios as described in Section 7.6.1.

The Danish market index has outperformed the global market index, and ATP's investment in Danish equities has outperformed both the global market and the Danish market indices. Exhibit 7.56 reports the performance regressions. We first compare the Danish market index versus the global market index. The Danish market index shows a 2.19 pct alpha per year over the global market index. We then compare ATP's investments in Danish equity versus the two stock market indices. ATP's investments in Danish equities show a 1.23 pct alpha per year versus the Danish stock market index and a 3.1 pct alpha per year versus the global stock market index. The appraisal ratios indicate substantial potential increases in the Sharpe ratio from extending the investments into ATP's investments in Danish equities; for example, by combining the Danish stock market with ATP's Danish equities, the Sharpe ratio increases from 0.71 to 0.78 (see Section 4.4.3 for the relation between Sharpe ratios and appraisal ratios). Finally, we note that while the alphas are economically significant, they are not statistically significant at usual significance levels.

Exhibit 7.56: Performance regressions for ATP's investments in Danish equities relative to investments in the global and Danish stock markets, 2015–2025. The table reports estimates from performance regressions. The estimated alphas are annualized and expressed as percentages. The estimated appraisal ratios are annualized. [White \(1980\)](#) standard errors are reported in parentheses below the estimates of alphas and betas.

Comparison	Alpha	Beta	R-squared	Appraisal ratio
KAX CAP versus MSCI World	2.19 (2.95)	0.79 (0.06)	0.55	0.23
ATP versus KAX CAP	1.23 (1.12)	1.09 (0.02)	0.94	0.33
ATP versus MSCI World	3.15 (3.17)	0.91 (0.07)	0.58	0.30

The historical outperformance combines two distinct components, only one of which reflects a comparative advantage ATP can expect to sustain. The 2.19 pct annual alpha of the Danish market index over the global index is about the Danish market, not about ATP, and there is little reason to expect a single small market to deliver risk-adjusted outperformance over the global market in the long run. The component ATP can plausibly sustain is its selection alpha within the Danish market—the 1.23 pct per year by which its Danish equities outperform the Danish index—which is where its local knowledge, engagement, and stewardship become most visible. This is the narrower and more defensible basis for the home bias.

Incremental risk to the Risk-seeking Portfolios

The performance regressions suggest that ATP's investments in Danish equities carry significant beta risk (but less than a one-to-one relationship) and idiosyncratic risk from deviating from the investments in the global and Danish stock market indices. However, they do so with rewards in terms of alphas and as diversifiers.

To understand the magnitude of diversification of Danish equities in the total portfolio, it is worth recalling the relative risk allocation with and without diversification. The current relative risks (measured as incremental risk share) from Danish equities in Exhibit 7.51, Panel (a) are around 13.6 pct and 9.6 pct, respectively. This means a relative reduction in risk share of 72 pct for Danish equities. The corresponding relative risk reduction for the global equity factor is 86 pct. This suggests that one could swap more Danish equity risk into the portfolio, at the expense of the global equity portfolio, and obtain a better diversification. This certainly rests upon the model's assumptions and should thus only be considered indicative.

ATP has analyzed such diversification benefits from Danish equities on data, dating back to 1973. Their conclusion is that the risk allocation that maximizes diversification benefits historically is around 18 pct, compared to the approximately 15 pct that ATP currently has (Exhibit 7.51). However, these diversification benefits have not been used by ATP as a decisive factor when setting the risk share of Danish equities.

Sector exposure

The strategy on Danish equities has a substantial tilt to equal weights. Arguably, it may result in a more balanced sector allocation compared to the sector weights from market-cap weights. Exhibit 7.57 illustrates the sector weights for selected indices and the ATP investments. It suggests that that the sector weights in the Danish portfolio complements the sector weights in the liquid markets portfolio contributing to a more equal-weighted equity portfolio in total. This is not, however, a substitute for directly having exposure to global sectors—and ATP's factor risk parity strategy already deviates significantly from the sectors in market capitalization indexes (Sections 6.3.3 and 7.6.3).

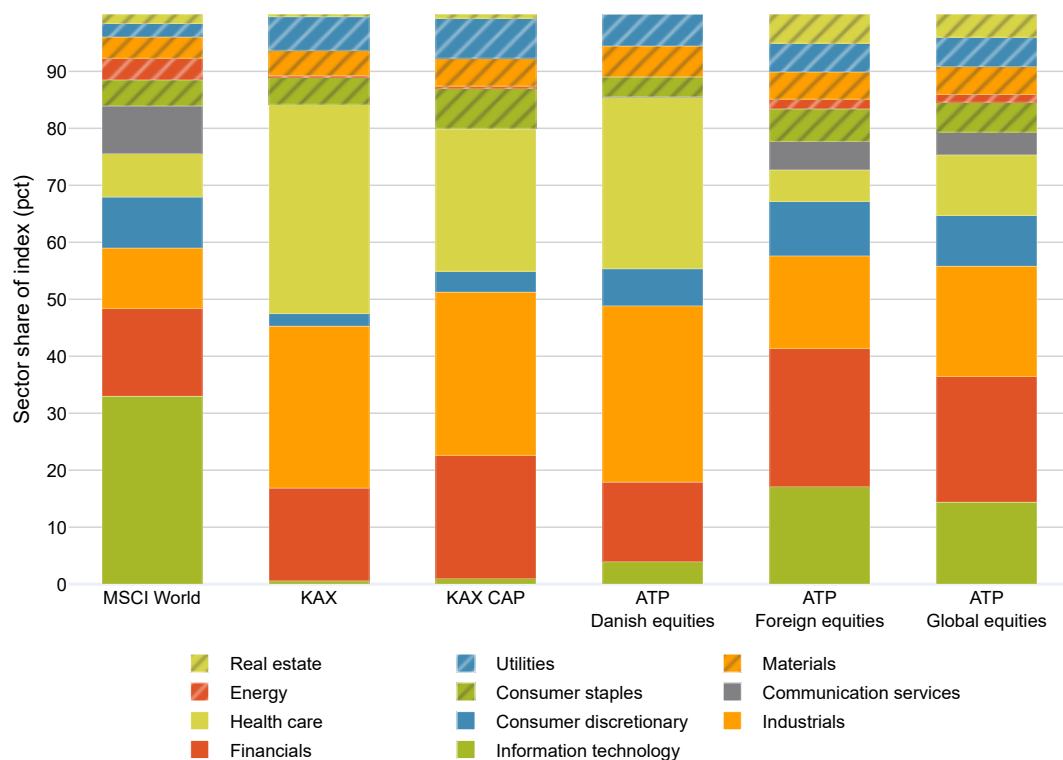


Exhibit 7.57: Sector exposure in listed equity portfolios. The figure shows, from left to right, the sector allocation in MSCI World, KAX (Danish market cap-weighted listed equity index), KAX CAP (KAX with maximum weights of 7 pct), ATP's portfolio of listed Danish equities, ATP's portfolio of listed Foreign equities, and ATP's portfolio of listed Global equities.

Exposure to Danish economy

A substantial argument against home bias, besides portfolio diversification, is the inherent exposure to the domestic economy induced by the investments. Since ATP's members are heavily exposed to the Danish economy, this constitutes a separate risk. However, a mitigating feature of the portfolio is that the portfolio companies are globalized and not very domestic in their business model (see [Dumas, Gabuniya, and Marston, 2022](#), for a discussion of the distinction between domicile and place of business). This is apparent from Exhibit 7.58, which shows that only around 10 pct of revenues in ATP's Danish portfolio companies are from Denmark, due to Denmark being a small open economy. This argument does not mean that Danish equities are a substitute for global equity exposure or that Danish equities have the same diversified revenues as international companies—only that the home-bias problem in ATP's portfolio is smaller than it would have been if the Danish portfolio companies were primarily domestic in their business model.

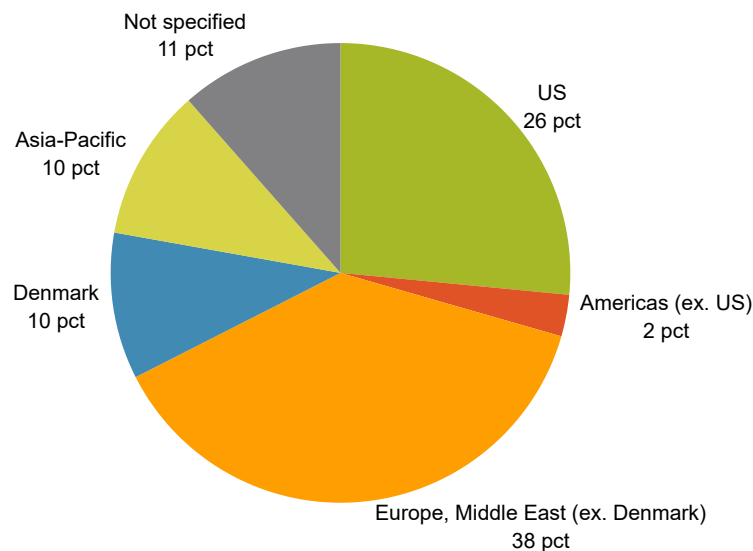


Exhibit 7.58: Country exposure of revenue in Danish listed equity portfolio. Numbers are based on annual reports for the financial year 2025.

Embedded dynamic risk share

ATP does not rebalance the portfolio of Danish equities to the same extent as in the global equity portfolio. The private component in Danish equities, still a small fraction, and is considered “buy and hold” in the short term, while the public component is only adjusted moderately with fluctuations in the Bonus Potential.

Nevertheless, the Danish equity market is small, and ATP's share of the market is not negligible (see Exhibit 7.49). To assess the embedded effects on rebalancing, consider Exhibit 7.59. The

period around the years 2022 and 2023 contains dramatic movements in risk. During this time, the swift de-risking of the liquid equity portfolio induced by the shrinking Bonus Potential reduced exposure from almost DKK 170 billion to below DKK 20 billion in one year yielding an exposure reduction of DKK 150 billion (a reduction of 90 pct). Over the same period, exposure in Danish listed equities decreased from around DKK 44 billion to around DKK 22 billion (a reduction of 50 pct). In October 2022, the exposure on Danish equities was slightly higher than the exposure on Global equities.

ATP has drawn two main conclusions related to liquidity and rebalancing from this. First, the liquidity in the Danish equity market was sufficient for ATP to rebalance, but the trading costs were higher than in global markets. The Danish equity market, for a participant of ATP's size, can be considered semi-liquid. Second, Danish listed equities made up roughly 50 pct of total liquid equity exposure during the lows of 2022. This is not an optimal portfolio allocation, with concentrated risk in a small market reducing diversification and potentially hampering ATP's ability to catch a rebound expected to happen on the back of the crisis. In fact, Danish equities did not perform as well as the global portfolio during the rebound, as can be seen from Exhibit 7.54.

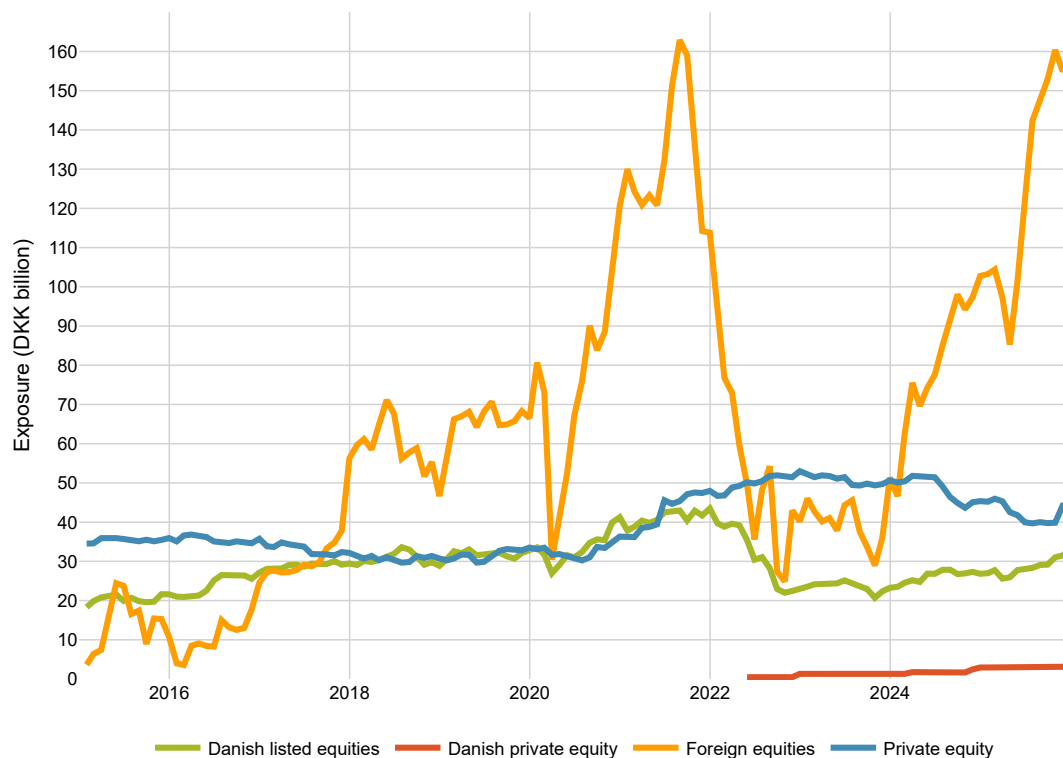


Exhibit 7.59: Exposures on different equity portfolios. The green, red, orange and blue lines show the developments in exposures on Danish listed equities, Danish private equity, Foreign equities, and Private equity, respectively.

Concentration risk

Concentration risk is a major feature of the Danish stock market. Exhibit 7.60 illustrates the degree of concentration in ATP's investment in Danish equities and in global and Danish stock market indices. The concentration risk within the Danish equity portfolio is markedly higher than for global equities. However, the equal-weighted tilt in the portfolio means that concentration risk is lower in the ATP portfolio than in the Danish market index. This is especially seen in 2024 before the large downturn in the value of Novo Nordisk, whose market value was more than 50 pct of the Danish listed market at the time. This does not make the Danish equities a substitute for global equity exposure; it only means that ATP's implementation reduces, but does not eliminate, the concentration risk inherent in the Danish market.

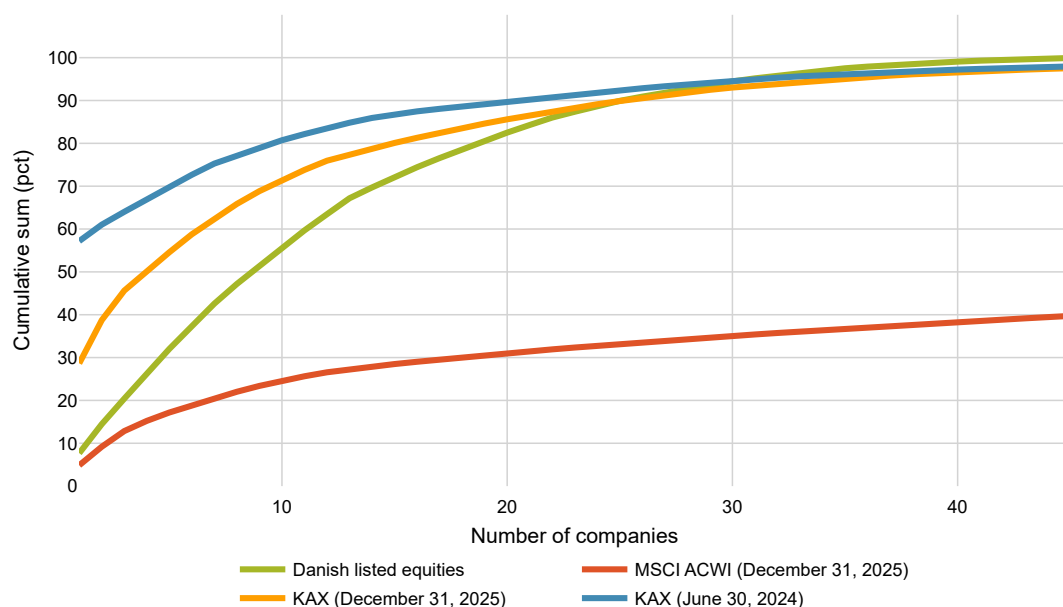


Exhibit 7.60: Concentration risk within the Danish listed equity portfolio compared to global and Danish stock markets. The figure shows the cumulative share of different portfolios as a function of number of companies ranked from largest to smallest.

Irrespective of the degree of concentration risk within the Danish portfolio, there is specific country risk associated with the home bias. This could be a geopolitical shock hitting Denmark as a country or some other presently unknown factor. Exhibit 7.61 illustrates the impact from an isolated “Danish” shock of 30 pct. The percentage point reduction in the bonus ratio hovers around 1, and currently the number is 1.3 (on a bonus ratio of around 20 pct). This is a significant reduction in the bonus ratio but not a drop likely to threaten the solidity of ATP. This does not make the country-specific risk immaterial; it means that even a large isolated Danish equity shock would be damaging for the bonus ratio but unlikely, on its own, to threaten ATP's overall solvency.



Exhibit 7.61: Drop in bonus ratio (in percentage points) from an isolated 30 pct shock to ATP's portfolio of Danish equities. The line depicts how much the bonus ratio hypothetically would have dropped, given ATP's historical balance-sheet, if Danish equities had been hit by an isolated shock of 30 pct.

7.7.3 Illiquid asset capacity

Key message

ATP has a sound rationale for investing in illiquid assets: it is a long-term investor with non-surrenderable liabilities, ample and low-cost funding, and large size. Illiquid assets may also broaden the opportunity set and provide some diversification. However, ATP's leveraged, dynamically rebalanced investment model means that the key constraint is rebalancing risk: the risk that ATP cannot adjust risk exposures in illiquid assets in the short term when the funding ratio changes.

ATP's illiquid allocation peaked at 25 pct of AuM (DKK 170 billion) in 2022 and has been brought down to approximately 17 pct (DKK 120 billion) by end-2025. Compared to Danish guaranteed pension funds, this is not a high allocation to illiquid assets, but ATP's inflation indexation ambition on top of nominal guarantees and leveraged Risk-seeking Portfolios create a greater need to rebalance risk dynamically than is typical for other guaranteed pension funds. Following the pattern of capital allocation to illiquid assets, the share of illiquid asset total risk rose sharply in 2022 reaching around 70 pct. This was very high because liquid risk was reduced while illiquid exposures could not

Key message (continued)

be adjusted quickly. Since then, ATP has reduced the illiquid risk share to a historical low of about 26 pct, partly through active management of illiquid exposures and partly through the phase-in of the Supplementary Hedge Portfolio (SAP), which absorbs a large share of the illiquid risk previously residing in the Investment Portfolio. This effectively allows the shift of the risk of illiquid assets to be moved from one part of ATP's portfolio to another part that is designed for more long-term, illiquid assets.

The new business model appears to make ATP's illiquidity risk more manageable, but it does not eliminate rebalancing risk. ATP's simulations show a 2022-like scenario would now produce an illiquid risk share in the Investment Portfolio of approximately 40 pct rather than the realized 70 pct and the illiquid share of AuM should remain stable in the 20 to 25 pct range. The Supplementary Hedge Portfolio now carries a large part of the illiquid risk, while the Investment Portfolio carries more of the liquid risk and remains the portfolio most exposed to rebalancing needs.

ATP's lessons learned in illiquid markets are consistent with patterns observed in the academic literature: direct ownership is demanding, vintage and size concentration matter, the choice of co-shareholders and governance structures is important, thematic investments can lead to poor entry points, and concentration discipline is essential. ATP's capacity to bear illiquidity supports continued investment in illiquid assets, but capacity is not the same as a comparative advantage in earning excess returns. ATP's framework is very strong on the risk side, yet it would benefit from further developing a returns or alpha framework that articulates how, and where, ATP expects to generate excess returns in illiquid markets given its constraints. ATP Real Estate and Private Equity Partners offer useful models of what has worked. Developing the framework for determining the optimal illiquidity share would further clarify the trade-off between potential illiquidity premiums and the rebalancing constraints created by ATP's business model.

This in-depth analysis concentrates on the following elements in ATP's illiquid investments: the rationale, the rebalancing constraints, historical and forward-looking risk-share dynamics, and the implications of the new business model for illiquid assets. (We comment further on the new business model in Section 7.7.6.) The realized performance of ATP's illiquid assets, including the relatively modest realized illiquidity premium of less than 1 pct over the evaluation period, is evaluated separately in Section 7.6.5.

ATP should invest in illiquid assets

Part of ATP's investment beliefs is that investments in illiquid private market assets for a long-term investor can contribute to a portfolio beyond the investment opportunities in public markets (Sections 6.1 and 7.3). ATP believes there is a positive illiquidity premium, which a long-term investor who has the capacity to bear illiquidity risk can harvest. This illiquidity premium can improve the long-term risk-return relation on the total Risk-seeking portfolio. That said, Section 7.6.5 shows the realized performance of ATP's illiquid investments over the evaluation period has been mixed—the realized illiquidity premium has been small (less than 1 pct) and some large direct investments have performed very poorly. On the other hand, areas like Private Equity Partners have had relatively strong performance. Other related reasons for investing in illiquid assets include that private market assets are part of the “market portfolio” and hence have a natural presence for the average investor and that private market assets are not perfectly correlated with public market assets and hence provide diversification. These reasons are consistent with economic theory as presented in Section 4.3.3.

ATP's risk model entails an illiquidity risk component within the Other factor, which introduces diversification and an illiquidity premium. One can debate how much diversification is truly provided by the illiquid assets in the ATP model. Arguably, most of the risk in illiquid assets are passed through the liquid factors and hence the diversification benefit is rather muted. Nevertheless, ATP has sticky liabilities, no surrender risk, and ample amount of funding available which all lean towards providing ATP with a comparative advantage to harvest the illiquidity premium potentially available in illiquid assets.

ATP's business model provides a strong capacity to invest in illiquid assets, but that capacity is constrained by rebalancing risk. ATP is a levered CPPI investor (Sections 4.1.4 and 6.5.3) with a high risk budget in the Investment Portfolio. It has a specifically formulated dynamic risk strategy, which underpins its understanding of risk, its expressed risk appetite, and its actual implemented risk mandates. In other words, the ability to rebalance under different market scenarios is important.

Rebalancing risk is the inability to reach a desired risk target and achieve a good balance between liquid and illiquid risks. Illiquid transactions involve a lengthy due diligence process and take a long time until invested in. Illiquid transactions also have high bid-ask spreads when traded in secondary markets. Hence, committed investments in illiquid assets can induce rebalancing risk. There are two potential concerns. The first and main concern is that ATP may be stuck with too high a risk taken compared to the target risk if liquid assets are liquidated. This can happen when ATP has low funding ratios. The second concern, is the inability to lever the portfolio such that the risk-parity strategy can be maintained. This can happen when ATP

has high funding ratios.

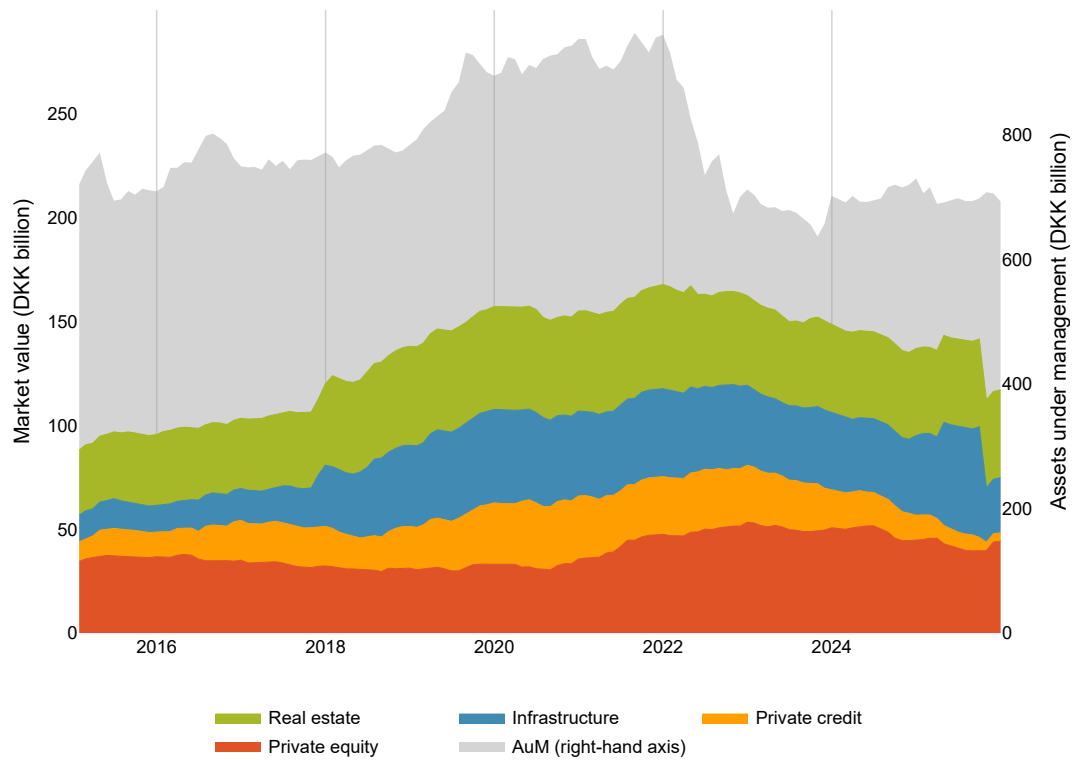
ATP's concerns regarding illiquidity risk arguably differ from the illiquidity concerns from other funds in the life and pensions sector. In contrast to many funds, the critical factor regarding the share of illiquid assets is not a lack of liquidity (which can create default risk) or surrender risk in the liabilities. Viewed from these risks, ATP has excess liquidity, since the illiquidity share of AuM is relatively low and ATP's members cannot surrender their insurance policies (in contrast for most funds in the life and pensions sector).

Historical allocations to illiquid assets

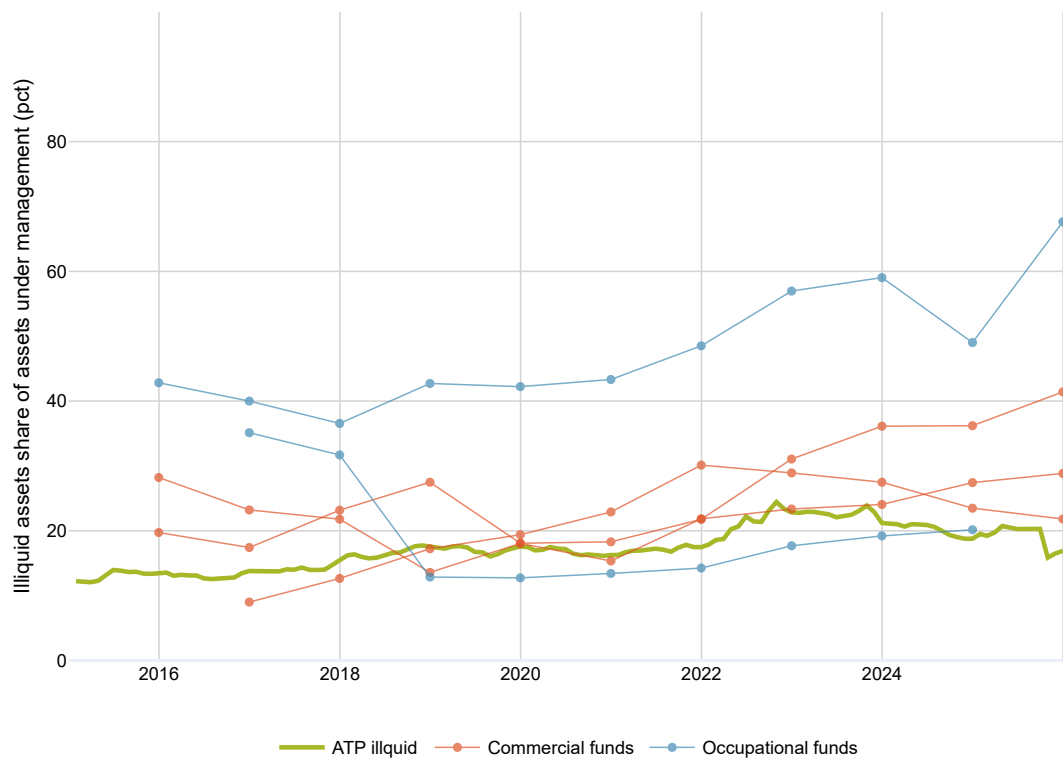
ATP's illiquid assets as a share of total AuM peaked in 2022 at 25 pct and is not high when compared to other guaranteed pension funds. Panel (a) in Exhibit 7.62 shows the market value in ATP's illiquid assets, and Panel (b) shows the illiquid assets as a share of total AuM. From 2015 and onwards there is an increase in market value until it peaks at the end of 2021 at DKK 168 billion. From 2017 to 2020, ATP significantly increased exposure to illiquid assets, with the increase from 2020 to 2022 primarily coming from increase in net asset values (positive returns). Since 2022, the market value of illiquid assets has steadily fallen and is currently at DKK 117 billion (equivalent to a share of AuM of 17 pct). ATP started to reduce its exposure to illiquid assets around 2020, but since the positions take time to exit, the decrease has not been visible until recently. ATP's share of illiquid assets is in the lower range of the shares of other pension funds with guaranteed products.⁹¹

⁹¹Illiquid assets are based on accounting notes, "Assets associated with average rate policies," found in the annual reports of the pensions funds considered. Illiquid assets are based on real estate, unlisted shares, and loans. For the commercial companies, the liabilities are based on "notes regarding the guaranteed policies" and are the sum of guaranteed benefits, individual bonus, collective bonus, and risk margin. For the occupational pension funds, the liabilities are the total liabilities less debt. Thus, the occupational pension funds also benefit from equity capital. For the commercial funds, it is less clear how equity capital should be allocated to guaranteed policies, whereas it is straightforward for the occupational pension funds.

Review of ATP's Investment Strategy



(a) Illiquids / AuM for ATP



(b) Illiquid capital share for ATP and Danish funds

Review of ATP's Investment Strategy



(c) Alternatives capital share for ATP and the average Danish pension fund

Exhibit 7.62: ATP's exposure to illiquid assets. Panel (a) shows the market value in the asset classes in illiquid assets (Private equity, Private credit, Infrastructure and Real estate); Panel (b) shows illiquid assets as a share of total AuM for ATP and other guaranteed products for commercial and occupational funds in the Danish pensions sector; Panel (c) shows alternatives as a share of total AuM for ATP and an average of the Danish pension sector. Source: Company accounting and Danish Financial Supervisory Authority. The definition of alternatives in Panel (c) follows the Danish Financial Supervisory Authority.

ATP has followed the overall trend by investing more in alternatives, but ATP's share has been lower than the pension sector overall. Panel (c) in Exhibit 7.62 shows ATP's allocation to alternatives as defined by the Danish Financial Supervisory Authority. This definition differs from ATP's definition of illiquid assets (which includes hedge funds, but excludes Real estate). The figure shows that ATP's share of alternatives also peaked in 2022 (around 18 pct of AuM). Currently, the share of illiquid assets is around 12 pct of AuM. Notably, ATP's share of alternatives is lower than in the Danish pension sector as a whole.

Generally, ATP's allocation to illiquid (or alternative) assets is not, and has not been, high compared to other Danish pension funds. However, ATP has a different product and hedging strategy, which should lead to different optimal shares of illiquid assets. ATP's business model is different even from the pension funds with guarantees because ATP runs a levered Investment Portfolio under a (partial) CPPI strategy. For this reason, while comparisons are relevant, they should be interpreted with some caution.

Historical rebalancing risk

ATP has experienced rebalancing risk historically, most noteworthy in 2022. Panel (a) of Exhibit 7.63 shows the allocated risk to liquid and illiquid assets for ATP's Risk-seeking Portfolios. While the allocated risk to the illiquid assets is relatively stable, the illiquid asset risk varies considerably. Illiquid assets cannot be adjusted in the short run, so the liquid asset portfolio is used to adjust the total risk allocation towards the target. The primary need for rebalancing lies within the Investment Portfolio, where risk allocation varies with the size of the Bonus Potential.

The historical illiquid risk share peaked at almost 70 pct in 2022 but has since been brought down to its lowest level since 2015. Panel (b) of Exhibit 7.63 shows the share of risk in illiquid assets to the total risk. It highlights the dynamics and that during 2022, the share of illiquidity risk rose from around 40 pct to 70 pct. Since 2023, the strategy to bring down overall illiquid risk has resulted in lower illiquidity risk shares, which is currently at a historical low of 26 pct. The illiquidity share during the 2020–2023 period is further analyzed in Section 7.7.4.

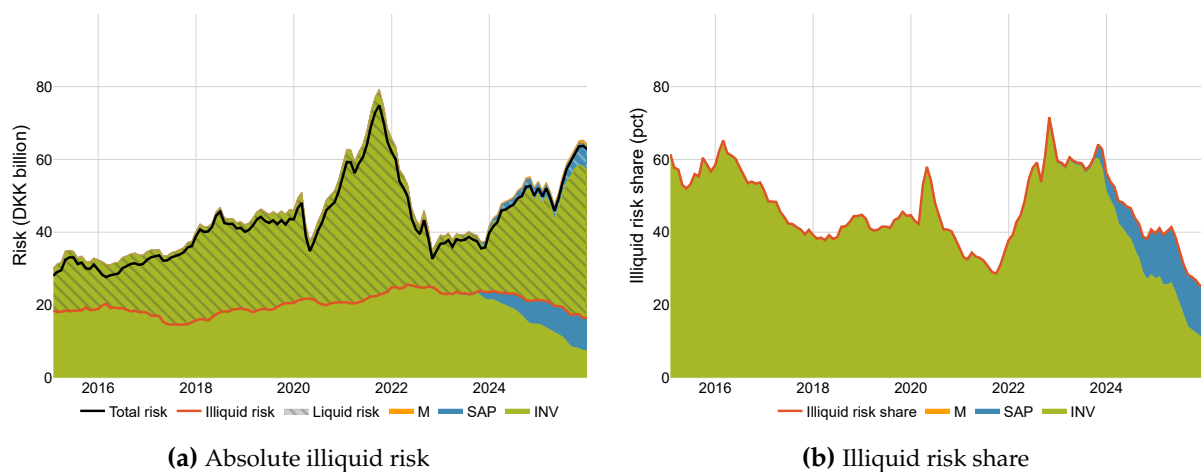


Exhibit 7.63: ATP's illiquidity risks. Panel (a) shows the risk in liquid and illiquid assets ES(99 pct, 3M). Panel (b) shows the share of risk in illiquid assets (defined as illiquid risk divided by the sum of liquid and illiquid risk). Both panels also identify which ATP portfolio carries each component of risk.

The share of illiquidity risk in the Investment Portfolio, which is the portfolio susceptible to rebalancing risk, has been lowered, partly through management of the illiquid assets and partly by the phase-in of the new business model. Exhibit 7.63 also shows which ATP portfolios carry the liquid and illiquid component of risk. The risk in the Risk-seeking Portfolios is currently divided evenly between the Investment Portfolio and the Supplementary Hedge Portfolio. Thus, the reduction of illiquid risk in the Investment Portfolio is both due to management of the illiquid assets but also the phase-in of the new business model. Section 7.7.6 further discusses the new business model.

Current illiquidity risk targets

The illiquidity risk in the Market Return Portfolio should be comparable to a medium risk product in the higher end of the spectrum with a 30 pct risk share (see Section 4.6.2). This approximately equals an illiquid risk target of 4.8 pct ES(99 pct, 3M) and a liquid risk target of 12 pct ES(99 pct, 3M). The allocation to illiquid assets corresponds to a 33 pct market value allocation in a diversified illiquid portfolio.

The illiquidity risk in the Supplementary Hedge Portfolio is as high as 70 pct, due to the long-term nature of the portfolio and the illiquidity of the liability it supports. This approximately equals an illiquid risk target of 1.75 pct ES(99 pct, 3M) and a liquid risk target of 0.8 pct ES(99 pct, 3M), both in percentages of the guaranteed benefits. The allocation to illiquid assets corresponds to a 12 pct market value allocation in a diversified illiquid portfolio.

The illiquidity risk in the Investment Portfolio depends on the level of the Guaranteed Benefits, rather than on the level of Bonus Potential. This is reasonable given the more stable guaranteed benefits and their status as an illiquid long-term anchor point. However, since the Bonus Potential is volatile, this puts a limit to the size of the illiquidity risk that can be borne. In particular, the ability to rebalance the Investment Portfolio is of paramount importance. Hence the illiquidity risk target is set at 1.5 pct of GY, corresponding to 7.5 pct of BP at a funding ratio of 120 pct.

Rebalancing risk depends on ATP's solvency

There is ample room for illiquid assets, but the current strategy requires derivatives to implement the liquid assets. Exhibit 7.64 shows the risk allocation of the total balance sheet. Panel (a) shows the current dynamic risk strategy, where the Supervisory Board has decided to keep risk constant in the Investment Portfolio for low levels of the Bonus Potential. As the funding ratio decreases to 1.1, the risk allocation and leverage (excluding the implicit leverage obtained via swaps in the Interest Rate Hedge Portfolio) also decrease. This lower leverage can be obtained via the funding available in the bonds in the Interest Rate Hedge Portfolio. When the funding ratio increases, the risk allocation and leverage increase markedly and derivatives are needed to increase risk in the liquid portfolio. Thus, liquidity needs for meeting collateral calls on derivatives increases as ATP gets wealthier. However, in this situation, ATP is well suited to lower risk to preserve liquidity buffers.

To keep rebalancing risk manageable, the allocation to illiquid assets in the Investment Portfolio needs to be moderate, and the risk budget needs to be stable at low levels. Note from Panel (a) how the relative share of illiquid versus liquid assets changes as the funding ratio changes. The lower the funding ratio, the higher the relative allocation to illiquid assets. If the

illiquid share becomes too large, ATP loses the ability to manage risk allocations efficiently and a forced reduction in risk via sales of illiquid assets will most likely be very costly. When the funding ratio is 1.0, the illiquid and liquid portfolios are around 20 pct and 40 pct of AuM, respectively; that is, the illiquid portfolio is around 1/3 of the total Risk-seeking portfolio, which is much less than the historical high of around 2/3. However, Panel (b) shows that if ATP chose not to keep the risk budget constant at low funding ratios, the illiquidity share would become much larger.

If ATP were seeking to fully de-risk the Investment Portfolio at low funding ratio levels, a portion of the illiquid portfolio would need to be sold. ATP's strategy is to keep risk constant and positive at low funding ratios. Yet, one can hypothetically consider the scenario where the Supervisory Board instead chooses to de-risk the Investment Portfolio as the funding ratio drops to 1.0. Panel (b) assumes that the allocation to illiquid assets in the Investment Portfolio cannot be sold and thus the total risk does not drop to zero. In principle, ATP could alleviate this by an internal trade, where the Investment Portfolio sells the illiquid assets to the Supplementary Hedge Portfolio, which then offloads its liquid assets in the market. However, Panel (b) shows that the Investment Portfolio will still be sitting with residual illiquid exposure since the illiquid assets (and risk) in the Investment Portfolio is larger than the liquid assets (and risk) in the Supplementary Hedge Portfolio. This would translate to around 0.5 pct worth of annualized volatility (not shown in the exhibit). If ATP were seeking to reduce the risk in the Investment Portfolio to zero in such a scenario, illiquid assets worth around 0.5 pct volatility would thus need to be sold (equivalent to a reduction the illiquidity share from around 20 pct to 17 pct).

The illiquid part of the Supplementary Hedge Portfolio (SAP) carries a major part of the investment risk at low funding ratios. Generally, the Supplementary Hedge Portfolio carries the bulk of illiquid risk, while the Investment Portfolio carries the bulk of liquid risk. Hence, in the hypothetical situation where ATP chooses to de-risk at low funding ratios, SAP's ability to assume illiquidity risk becomes even more important.

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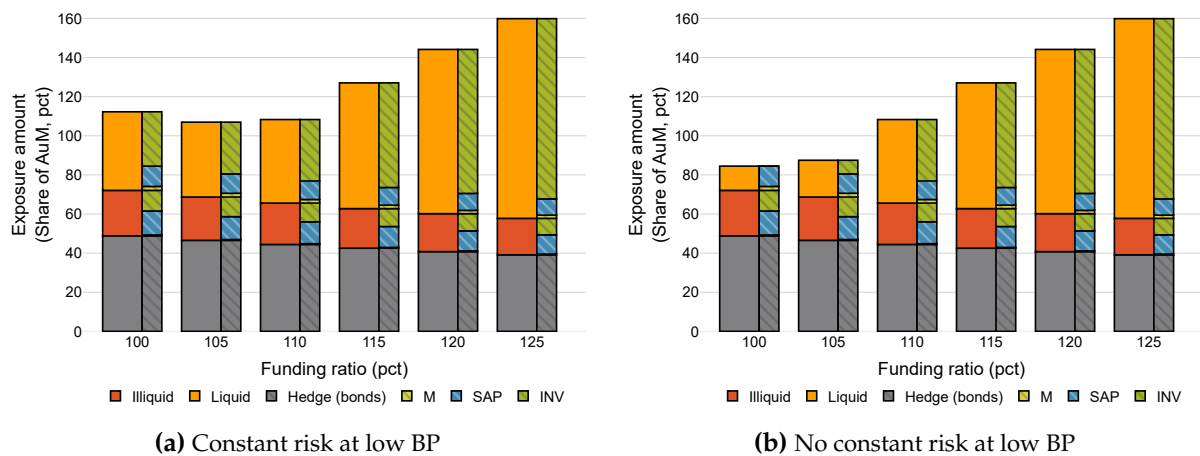


Exhibit 7.64: Balance sheet allocations as a function of funding ratio. The figure shows the notional allocation (or exposure) of the total balance sheet (including the Interest Rate Hedge Portfolio, which is shown as the market values of the bonds, as the swaps are equivalent to long term stable funding with collateralization). Notional exposure is the sum of the market value of assets bought as well as the notional on all underlying derivatives in the Risk-seeking Portfolios (such as equity, bond, commodity futures, etc.). The portfolios are based on the end-2025 balance sheet but using long-term targets for the allocation. It is assumed that the illiquid assets cannot be rebalanced when the funding ratio changes.

Rebalancing risk: Outlooks for illiquidity share and funding capacity

The above analysis illustrated the dynamic illiquid exposure as a function of the funding ratios, and in particular, it explored whether the size and strategy for ATP's illiquid assets is sustainable given ATP's risk appetite. The below analysis explores the outlook for ATP's risk in illiquid assets as well as how much of ATP's funding base is seized by illiquid assets. We also ask the question whether the introduction of the new business model has alleviated some of the concerns expressed regarding illiquid assets (further analyzed in Section 7.7.6). The analysis is done in simulations of ATP's entire balance sheet as of end-2025, and its investment strategy.⁹² We present histograms of the worst outcomes during the next 10 years, not the outcomes that happen at the end of the 10-year period.

The illiquidity share of AuM is relatively stable (predominantly ranging from 20 to 25 pct).

Exhibit 7.65 shows the histogram over the highest share of illiquid assets of AuM over the next ten years. The introduction of the new business model slightly improves this metric, although changes are small as the most profound effect of the Supplementary Hedge Portfolio has been to overtake a large part of the illiquid risk previously residing in the Investment Portfolio.

⁹²Illiquid assets are modelled as investments that can only be reduced through distributions and purchases of additional assets are made in blocks. They are subject to smoothing and lagging, to approximate real world reporting lags from managers.

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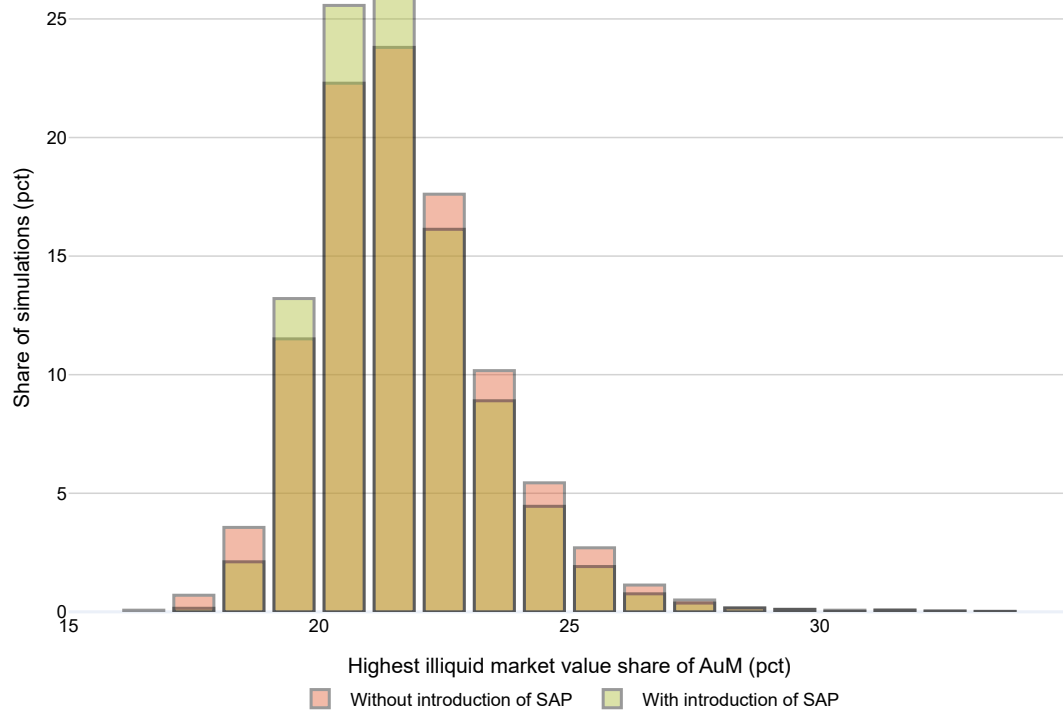


Exhibit 7.65: Histogram of the highest share of illiquid assets of AuM in 10-year simulations. The histograms show, with and without the Supplementary Hedge Portfolio, the highest share of illiquid assets of AuM over the simulated 10-year period.

ATP has the capacity to fund the illiquid assets. By using interest rate swaps to hedge the Guaranteed benefits, ATP can free up cash and fund liquid and illiquid risky assets. Due to the illiquid assets, it is especially important to understand how large a share of this funding capacity illiquid assets may need. Exhibit 7.66 illustrates this. In the worst scenarios, a share of up to 50 pct of the free funding is utilized, leaving the remaining 50 pct to fund liquid investments and treasury operations.

Review of ATP's Investment Strategy

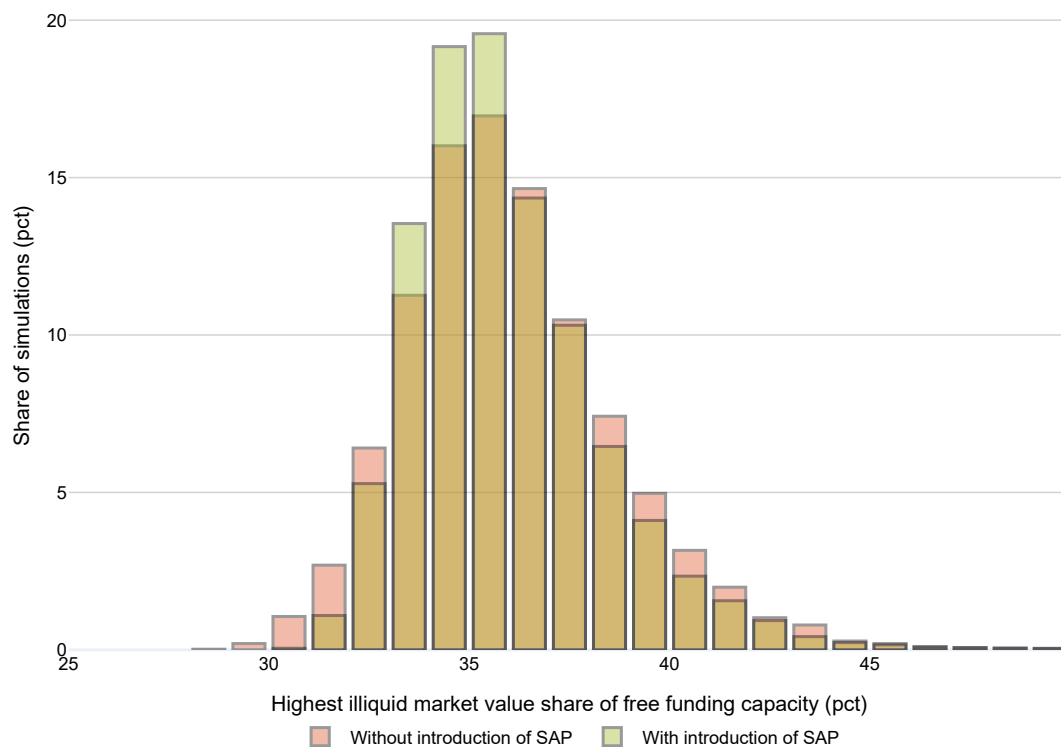


Exhibit 7.66: Histograms of the highest share of illiquid assets of free funding in 10-year simulations. The histograms show, with and without the Supplementary Hedge Portfolio, the highest share of illiquid assets of free funding over the simulated 10-year period. The free funding is the AuM minus the market value in the bonds and swaps hedging ATP's liability and (potential) tax asset.

The illiquid risk share for ATP's risky assets will be lower going forward due to overall higher risk on the balance sheet and a more stable risk budget. Panel (a) in Exhibit 7.67 shows the share of illiquid risk relative to the sum of illiquid and liquid risk for ATP's Risk-seeking Portfolios, while Panel (b) shows the share for the Investment Portfolio. The overall illiquid risk share is markedly lower with the introduction of the business model. A secondary effect is that the risk budget of the Supplementary Hedge Portfolio is more stable over time: There are fewer scenarios in which the risk budget for liquid investments is crowded out by illiquid investments. This is more pronounced in the Investment Portfolio, which indicates a more benign distribution; for example, a scenario as extreme as the 2022 experience would lead to a risk share around 40 pct.

Review of ATP's Investment Strategy

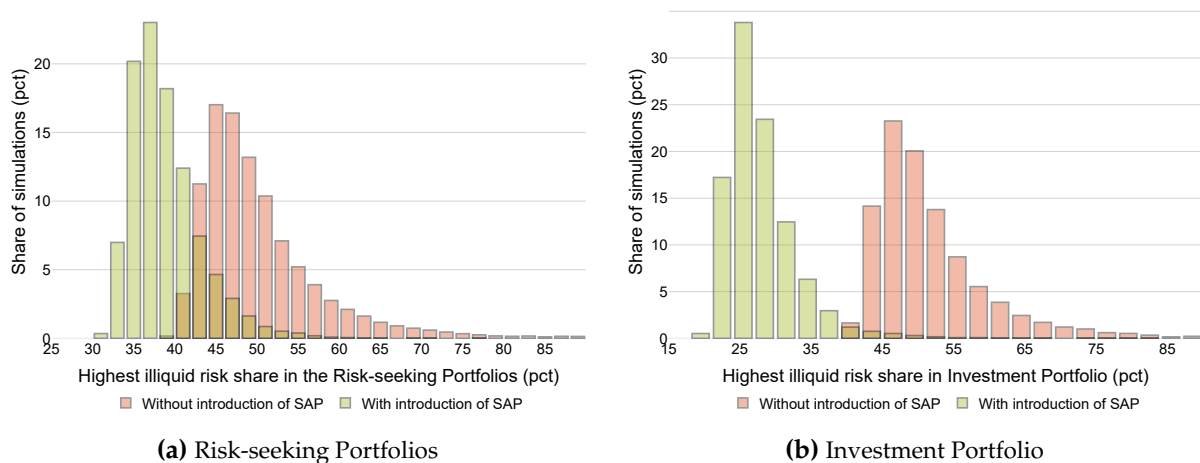


Exhibit 7.67: Histograms of the highest share of illiquid assets in 10-year simulations. The histograms show the highest outcome over the 10-year period of the risk in illiquid assets relative to the sum of the risk in liquid and illiquid assets for the Risk-seeking Portfolios in Panel (a) and the Investment Portfolio in Panel (b).

Taken together, the new business model seems to improve ATP's ability to bear illiquidity risk but rebalancing risk is still a constraint for ATP. The changes in business model have arguably led to an illiquid risk profile which is more manageable on ATP's balance sheet. Yet, the simulations do illustrate that rebalancing risk is still present and is an important constraint for ATP.

Evaluation of ATP's lessons learned in illiquid markets

ATP's lessons learned on illiquid investing are sensible and identify the main weaknesses of its previous approach to private market investing; the natural next step is to develop them into a forward-looking framework that can guide future illiquid investments. ATP has a world-class framework for measuring illiquid *risk*, including factor mapping, concentration limits, public market equivalent (PME) risk measures, rebalancing analysis, and funding capacity simulations. There are two areas where the framework could be developed further. The first is to set an optimal allocation to illiquid assets. The second is to further develop a returns or *alpha framework* in illiquid markets to complement its risk framework: what elements of the organization, investment staff, advantages in access or information, origination, or technology can translate the capacity for investing in illiquid assets into a source of consistent, excess returns?

ATP's long horizon, sticky liabilities, scale, and lack of surrender risk create the capacity to bear illiquidity (Section 4.3.1). Within sensible limits, ATP should therefore be invested in illiquid assets; not using this capacity would leave structural advantages embedded in its liability profile unexploited. "Large, illiquid, and long term" is the necessary albeit far from sufficient condition for investing in illiquid assets; capacity to bear illiquidity is not the same as a comparative advantage in earning excess returns from illiquidity. What specific advantages—

like privileged access, superior manager selection, governance rights, cost advantages, local knowledge, patience, or the ability to support long-term transitions—does ATP have to convert the capability for holding illiquid assets to excess returns?

Lessons learned

We agree with the lessons ATP identifies from its illiquid investments. Direct ownership is difficult, vintage concentration matters, governance structures and co-shareholder selection are crucial, thematic investment cycles can lead to poor entry points, and concentration discipline is essential. These points are well-grounded in the academic literature (see Section 4.3) and are the right lessons. Going forward, their value lies in embedding them in a framework that guides investing in illiquid assets. [Andonov and Rauh \(2021\)](#) document that pension funds tend to over-estimate expected returns in alternatives, a tendency that a clearly articulated illiquid investments framework can help to discipline.

ATP's lesson that "themed investments are not always successful" is right, and is consistent with the academic literature on private market vintages and pro-cyclical commitment patterns documented by [Kaplan and Schoar \(2005\)](#), [Harris et al. \(2023\)](#), and others. Thematic commitments are often made after a theme has taken hold in the markets and valuations have become stretched. The cost of chasing themes also applies to liquid markets. [Ben-David et al. \(2022\)](#) document that specialized ETFs, which are launched precisely when a theme attracts retail and institutional attention, underperform broad-market ETFs. [Blitz \(2021\)](#) shows that thematic equity indexes carry persistently negative loadings on the rewarded factors—value, low volatility, and quality (Sections 4.2.1 and 6.3)—so the construction of thematic baskets is mechanically tilted away from long-run sources of expected return, without even accounting for elevated sentiment at the time the thematic products are launched. [Phalippou \(2023\)](#) makes the same point in private equity: applying textual analysis to the deal descriptions of PE-backed investments, he identifies deals that cluster around the most prominent themes of each vintage and shows that thematic deals deliver lower returns than non-thematic deals from the same vintage.

Illiquid alpha capabilities

ATP's framework for illiquid assets is very strong on the risk side—including factor mapping and illiquidity factor risk targets—but would benefit from a more developed returns or alpha framework. ATP has developed a framework for its illiquid investments, including deal sourcing, due diligence, inception, and asset management (see Section 6.8.1 for the framework and Section 6.8.2 for ATP's lessons learned). However, we encourage ATP to further develop its framework. This entails developing a strategic plan for how it intends to generate alpha in

illiquid markets—how to identify value-adding managers, source mispriced deals, achieve access to the best managers, time optimal exits, negotiate fees and governance rights. In short, a strategic plan for ATP to develop a sustainable comparative advantage to generate alpha in illiquid markets. In illiquid assets, more risk does not mechanically imply higher expected returns; in public markets, investors can harvest broad, systematic factor premiums (as discussed in Sections 4.2 and 6.3; see [Ang, 2014](#), for a summary). The return framework in illiquid assets is important because private market performance is highly dispersed, manager selection matters, and limited partners differ sharply in their ability to access and select top-performing funds ([Kaplan and Schoar, 2005](#); [Lerner, Schoar, and Wongsunwai, 2007](#); Section 4.3.4). [Cavagnaro et al. \(2019\)](#) document that cross-LP dispersion in private equity selection is statistically attributable to skill rather than luck. Performance in private markets is also highly persistent—so a credible process for gaining access to and selecting high-performing managers is important, since the consequences of weaker relationships can persist across vintages.

The structural constraint that makes such a framework challenging is the one ATP itself flags in Section 6.8.2: “Institutional investors like ATP should focus on attracting the right competencies that fit the business model rather than trying to emulate private market funds.” [Dyck, Manoel, and Morse \(2022\)](#) show that public pension funds with constrained compensation systematically underperform in alternative assets, particularly private equity, because they cannot attract and retain the in-house talent needed for direct deal selection. The Canadian pension funds, by contrast, are widely cited as the public-pool success story in private markets and they pay competitively and operate large in-house teams ([Beath et al., 2021](#); Section 4.5.5). For ATP, the implication is not that it cannot generate alpha in illiquid markets, but that the alpha thesis must be realistic about the organization's constraints.

ATP does, however, have two success stories in private investments—ATP Real Estate and Private Equity Partners—and it could use these as models to develop more alpha capabilities in other areas of illiquid markets. While different in nature, they suggest a plausible business model with specialized subsidiary platforms, disciplined manager selection, negotiated fee advantages, diversified vintage exposure, reputation advantages, and proprietary data infrastructure built over time. Private Equity Partners is important because on average it has materially outperformed or matched the direct program without extreme losses, and operated at relatively low cost compared with other funds-of-funds. ATP may also have advantages from its long horizon, staying power, and a degree of access granted by virtue of its unique role in Danish society particularly in infrastructure and real estate, an advantage that cannot be easily replicated by commercial private equity firms. While ATP has tilted its focus more towards partnership-based investment models, the forward-looking framework should formalize what made these examples work and apply that discipline across the illiquid portfolio, while rec-

ognizing that the broader record of direct deal selection has been more mixed, with a realized illiquidity premium of less than 1 pct per year over the evaluation period (Section 7.6.5).

Concentration and rebalancing

ATP's new typical investment size is a useful correction to the size discipline (Section 6.8.2), but for a systemically important Pillar 1 institution the case for concentration limits has to reflect not only the financial concentration risk but also the political and reputational cost of visible losses. Positions such as Northvolt, TDC, and Copenhagen Airport illustrate that large, visible illiquid investments can attract disproportionate public attention even when they represent only a small share of a diversified balance sheet. They have generated a high degree attention even though the majority of the private portfolio has outperformed on PME and some other metrics (Section 7.6.5). The cost of those reputational episodes spills over into how ATP's overall pension strategy becomes subject to public debate. Concentration limits for direct positions could therefore be set tighter than a pure expected return and volatility framework would imply, with explicit Supervisory Board-level acknowledgement of the reputational dimension (see also Chapter 9).

The ATP-specific portfolio-level constraint, separate from the deal-level concentration, is rebalancing risk within a levered, dynamically managed balance sheet. As Section 4.4.4 discusses, illiquidity creates a shadow cost because the investor cannot freely adjust exposures when the desired risk level changes. In models like [Ang, Papanikolaou, and Westerfield \(2014\)](#) there are very large temporary fluctuations above 50–60 pct in the proportion of illiquid assets even for modest long-run holdings of illiquid assets that are below 10 pct. This is not only a technical portfolio-construction issue; it is also a communication issue. When liquid exposures are reduced after losses but illiquid positions cannot be sold quickly, the measured share of risk coming from illiquid assets can rise sharply. In 2022, illiquid risk rose to approximately 70 pct of the Investment Portfolio risk because liquid risk was cut while illiquid exposures remained in place (see above and Exhibit 7.67). The new business model and the Supplementary Hedge Portfolio reduce this pressure—simulations show that a 2022-like scenario would now produce an illiquid risk share of approximately 40 pct rather than 70 pct (Exhibit 7.67b)—but they do not remove the constraint. These remain meaningful proportions of ATP's risk-bearing capacity, which reinforces the value of pairing the risk framework with an explicit view on the source of alpha and comparative advantage in illiquid assets.

ATP's reflections on its illiquid investments indicate the complexity of, and challenges with, illiquid assets, especially direct investments. The reflections highlight the difficulty of direct ownership, the need for specific competencies that are hard to attract, the crucial choice of co-shareholders and governance structures, the avoidance of concentration risk on size and

vintage, and the mixed success of thematic investments. We concur with these reflections and view ATP's strategic focus moving forward as sound. Using the analysis on illiquidity and rebalancing in the new business model (further evaluated in Section 7.7.6) as a starting point, we see a need to better understand the rebalancing constraints under various assumptions for management actions, and the feasibility and cost of acting. More importantly, we see a need for a framework and further analysis regarding the optimal illiquidity share. This could better inform us about ATP's trade-offs between illiquidity risk and rewards.

7.7.4 Performance over 2020 to 2023

Key message

Overall, the period 2020–2023 serves as an informative stress test: returns were weak, especially in 2022, but ATP's balance sheet remained robust, the hedge portfolio continued to match the liabilities and the funding ratio was maintained, and the treasury and liquidity setup avoided forced deleveraging. At the same time, there were large increases in the risk and capital share of illiquid assets that did pose some constraints on rebalancing.

The 2020 to 2023 period encompasses two acute stress episodes—the March 2020 Covid crash and the 2022 simultaneous equity and bond market drawdown—during which ATP's funding ratios stayed remained high and the liquidity buffer held, but the factor-based investment strategy underperformed materially in 2022 and the rising illiquid risk share presented a constraint on rebalancing. The severity of the market crashes, and the rapidity of the corrections warrant a focus on developments at ATP during this period, and this section brings together material in the portfolio discussed in previous sections. The Covid episode delivered a short, severe equity drawdown followed by a rapid and sustained recovery on the back of unprecedented monetary and fiscal support. The 2022 shock produced a joint stock-bond drawdown, with US bonds having the worst return in over a century (as discussed in Section 7.2.3) and was an outlier from the post-2000 pattern where bonds generally diversify equities. This section also synthesizes evidence developed elsewhere in the report to give a better overview of 2020 to 2023 as a stand-alone return episode. We document how the market dynamics over 2020–2023 affected ATP's factor returns, how ATP maintained risk exposure and liquidity buffers over the period, and show that ATP's pension balance sheet was more resilient than asset-only return comparisons suggest. Nevertheless, ATP's illiquid asset positions represented large sources of risk when risky asset prices fell, especially during 2022, as they could not be rebalanced.

Investment returns

ATP's liquid fund tracked the market story closely, with a sharp March 2020 drawdown then with a rebound roughly two and a half times the size of the drawdown through mid-2021, followed by large losses in 2022; the illiquid fund returns are smoother because of the lack of daily mark-to-market valuations and exhibited some 2020 losses but no 2022 drawdown.

Exhibit 7.68 reports investment returns on the liquid and illiquid portfolios. As discussed in Section 7.6.3, the liquid portfolio is dominated by the Equity and Rates factors. The Equity factor had a sharp drawdown in Covid 2020 and declined in 2022. The Rates factor did especially poorly in 2022. Combined, this led to ATP's portfolio underperforming in both 2020 and 2022. Over 2020 to 2023, ATP's liquid portfolio had a Sharpe ratio of 0.10 compared to 0.37 for a 60-40 equity-bond portfolio. While infrequent mark-to-market did contribute to the lower volatility of illiquid returns over 2020–2023 (Stafford, 2021; Coutts, Gonçalves, and Rossi, 2024), the illiquid portfolio also had lower exposures to the Rates factor and higher exposure to the Equity factor which helped insulate it from the 2022 rates shock. The absence of a markdown in 2022, however, should be interpreted cautiously. The Equity factor itself experienced large losses in 2022 (Section 7.6.3) and so the returns for the illiquid portfolio over this period reflect the slower valuation process in private markets.



Exhibit 7.68: Excess returns for the liquid and illiquid funds during 2020–2023.

ATP's balance sheet absorbed the shocks

ATP's balance sheet absorbed the shocks over 2020–2023: losses on the Interest Rate Hedge Portfolio were matched by lower values of the liabilities and losses on the Risk-seeking Port-

folios were absorbed by the Bonus Potential without pushing ATP into a critical funding position. Exhibit 7.69 reports the evolution of balance sheet items over this period. Panel (a) shows guaranteed benefits, Panel (b) shows the Long-term Supplementary Reserve (LSH), Panel (c) shows the Bonus Potential, and Panel (d) shows total AuM. The value of the Interest Rate Hedge Portfolio follows bond yields inversely (Section 7.2.1) and it only declines sharply during 2022 when interest rates rose rapidly. There was little risk to the guaranteed pensions as the Interest Rate Hedge Portfolio is designed to meet the guarantees (Sections 6.2.1 and 6.2). The change of the the Long-term Supplementary Reserve in Panel (b) is due to the increase in discount rates, rather than losses on the Supplementary Hedge Portfolio (SAP), which was not implemented in 2022. The Bonus Potential in Panel (c) reflects gains and losses from the Investment Portfolio, and therefore moves with the liquid and illiquid fund returns described above. Because the bulk of the ATP portfolio consists of the Interest Rate Hedge Portfolio, the movements in Panel (d) for ATP's AuM closely follows a similar pattern to the guaranteed benefits in Panel (a).

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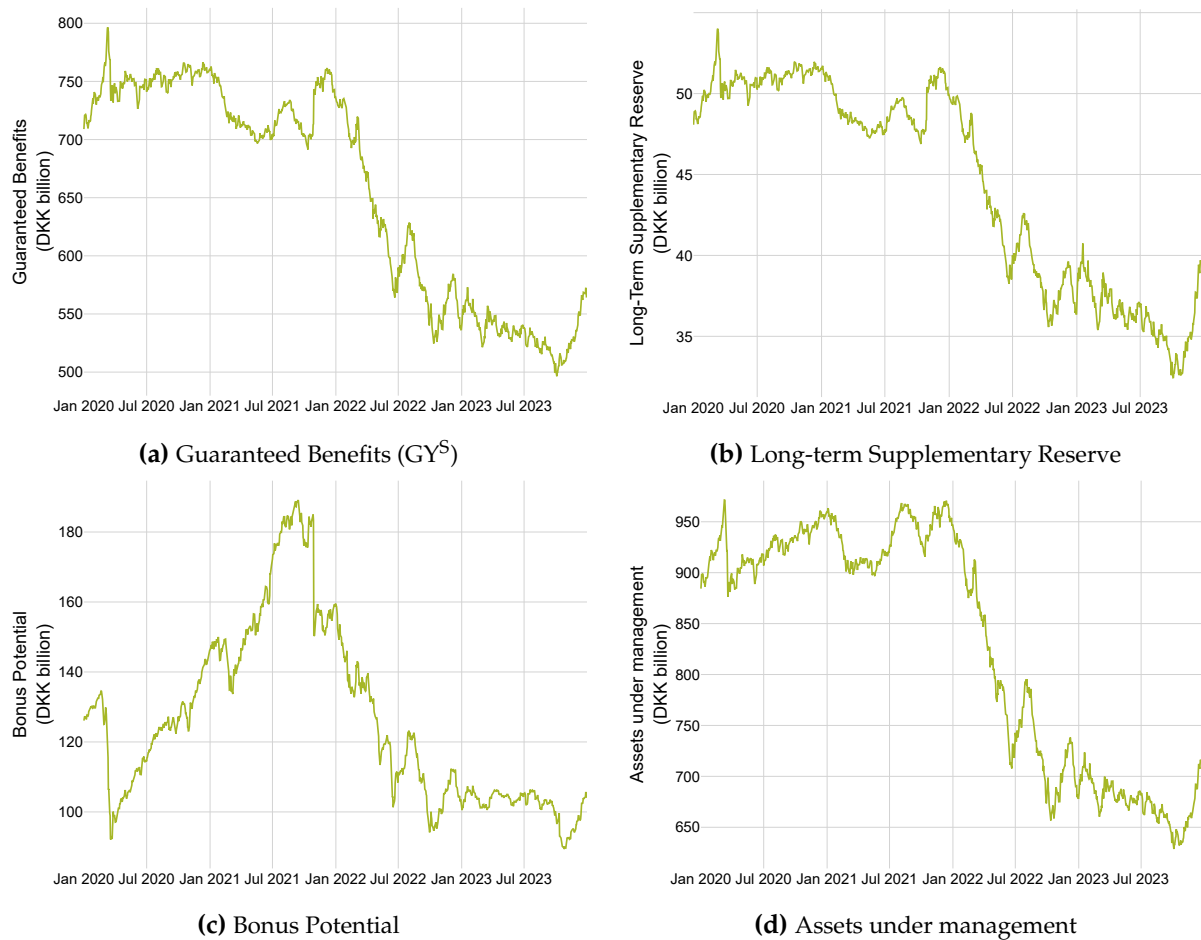


Exhibit 7.69: Balance sheet items over 2020–2023. Panel (a) shows the guaranteed benefits (evaluated including illiquidity spread), Panel (b) shows the Long-term Supplementary Reserve, Panel (c) shows the Bonus Potential, and Panel (d) shows the assets under management. Guaranteed Benefits are the present value of the liabilities including the illiquidity spread. Prior to 2023 the Long-term Supplementary Reserve (LSH) is based on approximation, as LSH officially was included as a liability item in 2023.

ATP's funding ratios remained healthy over 2020–2023. Exhibit 7.70 reports the funding ratio computed using a fully liquid liability (without the illiquidity spread), which reached its trough near the March 2020 Covid low at 112 pct. The exhibit also shows the discrete fall in the funding ratio at October 2021, which corresponded to the pension bonus allocation during that month. As bonuses are paid from bonus, the Bonus Potential declines (Sections 5.4.6 and 6.4.1). After the 2022 shock, the funding ratio remained above 116 pct because the 2022 losses on the Risk-seeking Portfolios were largely matched by reductions in the market value of the liability. The resilience of the funding-ratio path is set in stronger relief by the counterfactual analysis in Section 7.4.3 with Exhibit 7.10 (historical bonus ratio of ATP), which showed ATP's bonus ratio against hypothetical 60-40, all-equity, and all-bond portfolios holding contributions, benefits, and bonus strategy fixed; the counterfactuals would have produced more volatile bonus ratio paths over the same window. Thus, while 2020–2023 was a volatile period, ATP's funding position remained comfortably above critical levels.

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Exhibit 7.70: Funding ratios over 2020–2023. The figure shows the Bonus Potential relative to the liabilities valued without an illiquidity spread.

Rebalancing, liquidity, and illiquidity

The 2020–2023 episode showed that ATP had enough rebalancing and liquidity capacity to stay invested through stress, but it also exposed illiquid assets as one constraint on short-term risk management. Liquid exposures can be reduced or increased quickly; illiquid exposures cannot. As a result, when liquid markets fall sharply, the illiquid share of remaining risk can rise even if ATP has not deliberately increased illiquid risk. This is the main implementation lesson from the period: liquidity was sufficient, but the ability to rebalance total risk was partly shaped by the stickiness of the illiquid portfolio.

On rebalancing capacity, ATP maintained its intended risk exposures through 2020–2023 and did not permanently or temporarily de-risk; ATP tracked its tactical risk targets closely under the formal framework introduced in 2020. Exhibit 7.19 in Section 7.5.2 shows that, under the formal risk-target framework introduced in 2020, realized Investment Portfolio risk tracked the Board target and tactical target closely, with the largest deviations occurring around the Covid shock and the 2022 inflation and rates shock. Exhibit 7.19 plots the Investment Portfolio's realized risk against the Supervisory Board and tactical targets, with the 2020 Covid drawdown and 2022 rates shock both visible as moments when tactical deviations from the Board target were largest. Maintaining intended exposures through stress is what allowed ATP to participate in the post-Covid recovery from mid-2020 rather than locking in the March 2020 drawdown. However, ATP did not perform as well as a 60-40 portfolio in the rebound in 2023 after the joint equity-bond drawdown in 2022 (Exhibit 7.14 in Section 7.5.1) because ATP's factor strategy significantly underweighted global equities which had stellar returns in 2023.

ATP maintained sufficient liquidity over 2020–2023, with unencumbered cash remaining above 10 pct of the balance sheet despite large variation on its derivative book (see Exhibit 7.23 in Sec-

tion 7.5.3). ATP's competent treasury function gave it collateral capacity to absorb large market moves without forced deleveraging or crystallizing losses during the worst of the 2020 or 2022 drawdowns. Section 4.1.6 discusses that UK liability-driven investors experienced forced deleveraging and were forced to sell assets into falling markets during the UK gilt / LDI crisis in 2022. ATP was not, due to efficient treasury management, and an Interest Rate Hedge Portfolio with approximately 50 pct bonds and 50 pct interest rate swaps, coupled with the ability to post bonds as collateral for these interest rate swaps.

The stress years 2020–2023 revealed that ATP faced rebalancing constraints. Illiquid assets did not create a funding problem for ATP, but their share of risk and capital rose significantly. Exhibit 7.71, Panel (a) reports the illiquid risk share in the Investment Portfolio over 2020–2023. In March 2020, the risk share of illiquid assets rose from just above 40 pct to over 60 pct due to equities falling in the Covid shock. This was short-lived and the risk share decreased back to around 30 pct as markets recovered. In 2022 when both equities and bonds steeply fell, the risk share of illiquid asset risk rose to above 60 pct, and then remained elevated at that level over 2023. During this period illiquid investments could not be sold or resized quickly and the liquid portfolio shrank over 2022. In 2023, the liquid portfolio did not recover as fast as after the Covid crash in March 2020 (Section 7.6.4).

The illiquid market value relative to the total balance sheet was not extreme, ranging from 18 to 25 pct, however measured against the Bonus Potential the market value share of illiquid assets was significantly higher (mostly above 100 pct), as shown in Panels (b) and (c) of Exhibit 7.71, respectively. Panel (b) shows that ATP entered 2002 with an illiquid market value share relative to its total AuM slightly below 18 pct. However, the large drop in the balance sheet during the bear equity and bond markets of 2022 effectively increased the illiquid market value share to close to 25 pct. The illiquid share remained elevated through 2023 as the Interest Rate Hedge Portfolio largely remained unchanged as interest rates did not decrease to previous low levels. An illiquid share of 25 pct is not extreme and in theoretical models of optimal allocation to illiquid assets discussed in Section 4.4.4, there are large fluctuations in the share of illiquid assets which come from the inability to rebalance them. ATP's approach was to maintain risk targets, which they did successfully (Section 7.5.2) in spite of an increasing share of the portfolio not being able to be traded. Panel (c) reports the illiquid market value within the Investment Portfolio as a proportion of the Bonus Potential, which ranged from around 90 pct in late 2021 to around 170 pct during the 2020 Covid drawdown and in 2022. The high average level of illiquid capital in the Investment Portfolio, let alone the extremes reached in 2022 would not be possible if the Investment Portfolio was run as a stand-alone fund, and was only possible because of ATP's total balance sheet.

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(a) Illiquid risk share in the Investment Portfolio



(b) Illiquid capital share for total AuM



(c) Illiquid capital share for Investment Portfolio

Exhibit 7.71: Illiquid shares over 2020–2023. Panel (a) shows the illiquid risk share (illiquid risk divided by the gross sum of liquid and illiquid risk) for the Investment Portfolio. Panel (b) shows the illiquid capital share as a proportion of the balance sheet (illiquid AuM divided by total AuM). Panel (c) shows the illiquid market value within the Investment Portfolio as a proportion of the market value of the Bonus Potential.

7.7.5 Currency hedging

Key message

ATP hedges close to 100 pct of its non-euro foreign-currency exposure to Danish kroner, a policy that follows from its belief that currency risk is, on average, uncompensated, so that the fully hedged position is the neutral one. This is high by international standards, where hedging is partial and varies with asset class, home currency, and liabilities, and it is somewhat above ATP's Danish peers. Full hedging is nonetheless well-founded for ATP: in a mean-variance framework the optimal hedge is high for fixed income and lower for equities, especially for safe-haven currencies such as the dollar, but for ATP's fixed-income-heavy, balanced-beta portfolio, a hedge ratio near 100 pct is appropriate. Where ATP does want currency exposure, it is better taken as a deliberate, dynamically sized position, as in the Other factor, than as a standing deviation from full hedging, because currency risk premiums vary over time. The costs of hedging are small. The largest explicit cost, the cross-currency basis on the dollar, is much reduced by taking exposure through derivatives, though partly swapped for a financing spread embedded in derivative prices; the cost that binds hardest at ATP's scale is the liquidity and margin demand that a large hedge creates in stress. Either way, how ATP implements its hedges matters as much as the ratio it targets.

This section evaluates ATP's approach to currency hedging. We first describe how ATP hedges its foreign investments and set it against the hedging practices of other institutional investors. We then lay out, in words, the standard mean-variance framework for the optimal currency hedge and its three components (liability hedging, risk minimization, and speculation), and bring that framework to the data and to ATP's balanced-beta portfolio. We discuss the costs of hedging, and finally evaluate and conclude on ATP's chosen approach.

ATP's approach to currency hedging

ATP hedges the currency risk on virtually all of its non-euro foreign investments to Danish kroner, reflecting a core investment belief rather than expressing a view of an unconditional excess return or a tactical stance. This covers the entire developed-market exposure and a substantial share of the emerging-market exposure. As set out in Section 6.1, ATP seeks to hold no uncompensated risk and regards currency risk as, on average, uncompensated over the long run; on this view the fully hedged position, not the unhedged one, is the natural neutral starting point. This is similar to the way ATP fully hedges its guaranteed liabilities. It follows that any deviation from full hedging is a deliberate risk-taking decision that consumes risk budget and must clear a sufficiently high reward-for-risk hurdle, rather than arising as a

by-product of loosely managing a hedge ratio.

Governance and several practical considerations reinforce this policy. The Supervisory Board grants the daily management broad limits for currency exposure, and the CIO in turn defines narrower internal frameworks that keep exposure, outside the euro, close to fully hedged, so positioning is contained rather than left to desk-level discretion. The practical case is threefold: hedging keeps the portfolio broadly immune to large short-term exchange-rate fluctuations, it makes foreign investments easier to compare on a like-for-like basis, and it removes a risk ATP does not expect to be rewarded for bearing.

How ATP hedges depends on how it holds the underlying exposure, which is through a mix of cash instruments and derivatives. Cash assets (unlisted holdings, listed equities in some markets, and some bonds) have their currency exposure hedged explicitly, by rolling short-dated FX forwards. Exposure taken synthetically through derivatives such as equity futures, CDS contracts, interest rate swaps, bond futures, and inflation swaps is hedged implicitly, since the position is denominated and funded in the foreign currency without ATP ever holding the cash currency.

The two channels leave ATP exposed to currency risk in slightly different ways. Hedging through FX forwards exposes ATP to the so-called cross-currency basis, whereas taking the exposure implicitly through derivatives leaves it exposed mainly to the derivative funding costs. Which route is more attractive therefore depends on the cross-currency basis and derivative funding costs, a point we return to when discussing hedging costs.

The euro is treated differently from every other currency because the Danish krone is pegged to it. Denmark participates in the European exchange-rate mechanism, ERM II, under which the krone is held close to a central rate of 7.46038 kroner per euro within a formal ± 2.25 pct band, although Danmarks Nationalbank has in practice kept it within a far narrower range on the back of a long-standing and credible commitment. As long as the peg holds, euro exposure carries negligible currency risk (movements in DKK/EUR are tiny relative to those in floating currencies), so ATP does not hedge it and treats euro-denominated assets as effectively part of its domestic base.

The residual risk in this choice is that the peg itself might not hold, and it is left unhedged deliberately. A break or realignment of the peg is a low-probability but not impossible event, and hedging against it continuously would be costly and, in ATP's framework, may not be judged worthwhile. There are other systemic events that would likely occur across the euro area during such a break, which would affect all Danish financial institutions, extending well beyond just the currency exposure. As with other deviations from full hedging, the decision

is a conscious one: the peg is simply judged credible enough that the exposure is close to risk-free. ATP would lose in case DKK strengthens, a situation where the Danish Central Bank can print kroner at their discretion and buy foreign currency (euros).

Around 80 pct of ATP's foreign-asset exposure is implemented through derivatives, with the remainder held as cash assets hedged with FX forwards. Exhibit 7.72 shows ATP's notional-equivalent currency exposures in its Risk-seeking Portfolios on December 31, 2025, split by implementation type. The US dollar dominates, reflecting in particular the large notional positions in the Rates and Inflation building blocks. For the derivative positions, the currency risk is carried by the market value of the position rather than by its notional: the notional is a reference amount that is never exchanged, so the notional-equivalent figures overstate the currency risk of the derivative sleeve, most clearly for the large Rates and Inflation swaps, whose market value is a small fraction of their notional.

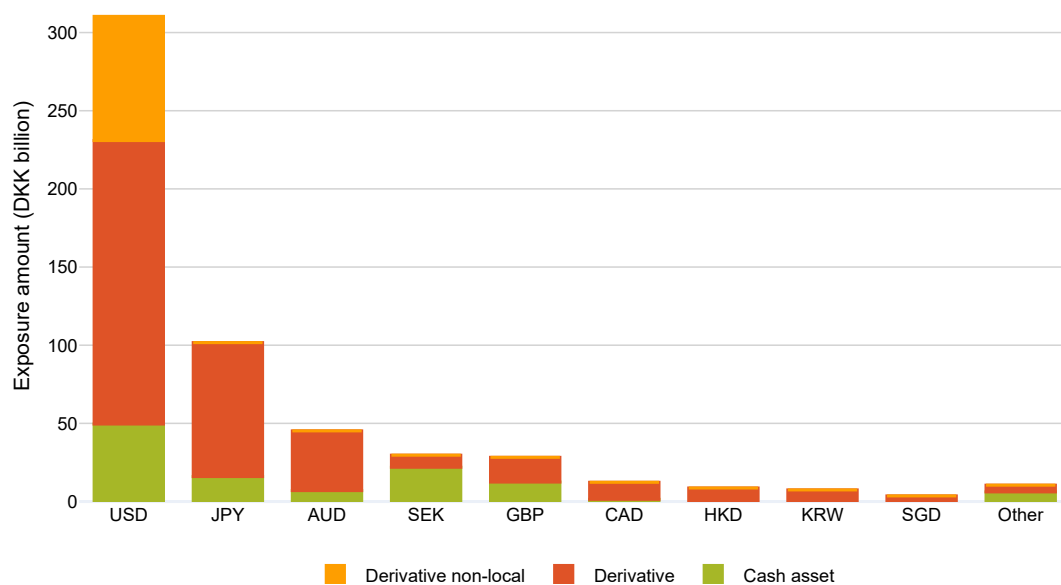


Exhibit 7.72: ATP's currency exposures by implementation type. The figure shows ATP's currency exposures in its Risk-seeking Portfolios as of December 31, 2025. Exposures are notional equivalent exposures, not risk exposures. "Cash assets" are typically private equity investments, listed equities in some countries, and some bonds. "Derivatives" are typically equity futures, CDS contracts, interest rate swaps, bond futures, and inflation swaps. "Derivative non-local" are mainly non-US based derivatives expressed in USD and commodity derivatives.

A meaningful part of this formal dollar exposure does not originate in US assets. It stems from non-US positions whose derivatives are expressed in dollars, as is the case for several emerging-market positions and for commodity exposures, so the dollar's weight in the exhibit overstates ATP's economic exposure to the US specifically. On top of the exposures shown, ATP runs active carry and momentum positions amounting to roughly DKK 15 billion of long and of short exposure at year-end 2025, which are the main way it deliberately takes on currency

risk.

Two sizeable blocks of exposure fall outside Exhibit 7.72: ATP's euro exposures in the Risk-seeking Portfolios and in the Interest Rate Hedge Portfolio. Consistent with treating the euro as quasi-domestic, the exhibit does not show the euro exposure in the Risk-seeking Portfolios, which at year-end 2025 was around DKK 243 billion—roughly DKK 205 billion taken through derivatives and DKK 38 billion in cash assets. A substantial portion of the Interest Rate Hedge Portfolio that backs the guaranteed liabilities is euro-denominated, around DKK 137 billion in cash assets (mostly German government bonds) and an equivalent amount through derivatives. While the derivatives positions do not carry a material currency exposure, the cash positions are euro-exposed and not automatically hedged to kroner.

This active currency risk is run in a contained way, through what ATP calls the Other factor. It is currently expressed through FX carry, momentum, and cross-asset strategies that sit on top of the otherwise fully hedged portfolio, translating into effective hedge ratios that differ from 100 pct on the total positions. The Other factor takes deliberate long-short positions that, over the long run, are expected to deliver positive excess returns—which is very different from the fully hedged currency position which is not associated with a long-run risk premium (see Section 6.3). The scale is small relative to the hedged foreign exposures: ATP could take considerably more, for instance sizeable FX-carry positions in yen against the dollar, but chooses not to, reflecting the same belief that underpins the full-hedging default, namely that currency risk is worth taking only where it is expected to be well rewarded—in the Other factor—relative to other investment opportunities competing for the risk budget.

Institutional hedging practices

There is no uniform currency hedging policy among institutional investors, and how much they hedge varies systematically along a few dimensions. Cheema-Fox and Greenwood (2026) provide comprehensive evidence by matching custodial asset holdings between 1998 and 2025 to the associated FX-forward positions for investors around the world. They measure hedging on two margins: whether an investor hedges a given currency at all (the extensive margin) and, among those that do, how much of the exposure they hedge (the intensive margin). On both margins the picture is one of partial and selective hedging rather than a common standard.

The asset class is the first-order dimension: foreign bonds are hedged far more than foreign equities. Currency movements account for most of the return variance of foreign bonds, but only a modest, and often diversifying, share of foreign equities, so the case for hedging is much stronger for fixed income. The data bear this out sharply: among dollar-based investors, only around 27 pct of equity investors hedge their currency exposure at all, against 51 pct of fixed-

income investors; and conditional on hedging, the average hedge ratio is around 33 pct for equity investors versus 60 pct for fixed-income investors. This is the empirical counterpart to the point made in Section 4.5.9, that foreign bond exposures are typically hedged heavily while foreign risky assets are hedged only partially.

The investor's home currency is the second dimension: those based outside the dollar hedge more than dollar-based investors. A krone-, euro-, or yen-based investor holding US assets faces the full fluctuation of the dollar, whereas a dollar-based investor's foreign exposure is spread across many currencies that partly offset one another. Non-dollar investors therefore hedge both more often and more intensively: around 85 pct of euro-based fixed-income investors hedge their currency risk against 78 pct of dollar-based ones, and conditional on hedging, euro-based investors hedge their dollar exposure around 92 pct while dollar-based fixed-income investors hedge 60 pct. Hedging has also risen steadily across the board since the Global Financial Crisis.

The type of institution is the third dimension, and here the liabilities matter. [Du and Huber \(2026\)](#) provide cross-institution estimates and find a clear ordering: insurers hedge most, pension funds next, and mutual funds least, with average dollar hedge ratios of roughly 44 pct, 35 pct, and 21 pct, respectively, in 2020 (these figures describe broad patterns and are not necessarily comparable with the figures in [Cheema-Fox and Greenwood, 2026](#), above). The ordering tracks liabilities and regulation rather than risk-return optimization. Insurers and pension funds hold foreign assets against domestic-currency liabilities, which gives them a matching motive to remove foreign-currency risk; European insurers in particular fully hedge, or close-to-fully hedge, their foreign-currency bonds, partly because Solvency II charges regulatory capital against currency mismatches. Mutual funds, by contrast, have no liabilities and hedge mainly for benchmarking and clientele reasons, consistent with [Sialm and Zhu \(2024\)](#), who find that US international fixed-income mutual funds hedge only about 18 pct of their currency exposure, on average. Against this backdrop, ATP's policy of hedging close to 100 pct sits at the high end of the institutional spectrum, well above what dollar-based and equity investors typically do, and is naturally closer to the behavior of non-dollar, liability-driven bond investors.

ATP's closest comparators are its Danish pension peers, whose hedging is shaped by the same fixed-exchange-rate backdrop. [Steffensen, Jensen, and Grønlund \(2024\)](#) use granular transaction data to document that more than half of Danish pension assets are held in foreign currency: predominantly dollars, mostly in equities, and euros, mostly in bonds. Because the krone is pegged to the euro, the sector tends to hedge in two steps: non-euro exposures are first hedged into euro (the dollar–euro forward market is deeper and cheaper than dollar–krone, and euro

exposure attracts almost no regulatory capital), and the resulting euro exposure is then only partly hedged on to kroner.

The two currencies—US dollars and euros—are therefore managed very differently. The sector hedges roughly 70 pct of its aggregate dollar exposure and holds that ratio broadly stable, rebalancing as dollar asset values move; about 70 pct of that dollar hedging is routed via the euro rather than straight to kroner. Euro exposure, by contrast, is only around 40 pct hedged back to kroner, and that share is cost-sensitive: it follows Danmarks Nationalbank's policy-rate spread to the ECB, and funds trimmed it by some six percentage points when the spread widened in 2022–23. Individual funds also differ with their liability mix: those with more traditional average-rate guarantees hedge more than those dominated by market-rate products, since only the former attract a currency-capital charge. Against this peer group, ATP's near-complete hedging of its non-euro foreign currency again stands out as high but less so than when compared to other international investors.

Optimal hedge ratios

Optimal currency positions can be analyzed as an overlay on top of a given asset allocation. Taking the portfolio's asset weights as given, the currency decision becomes a separate mean-variance problem in the investor's home currency (Glen and Jorion, 1993), which for ATP is the krone. A convenient feature of this framing is that the optimal currency position can be solved independently of the asset allocation, even though the allocation should in principle anticipate how the currencies will be managed. The theoretical framework delivers the optimal hedge ratio as the outcome of a few competing demands, which we take in turn and relate to empirical observations.

The optimal currency position is the sum of three demands: a liability-hedging demand, a risk-minimizing demand, and a speculative demand. This mirrors the decomposition of portfolio choice in Section 4.1.4. The first two are hedging demands, one arising because the investor has liabilities to protect and the other because currency exposure can reduce the risk of the asset portfolio, while the third responds to expected currency excess returns, that is, to currency risk premiums. The framework follows Viceira and Shen (2026) and, for the risk-minimizing component, Campbell, Serfaty-de Medeiros, and Viceira (2010).⁹³

The liability-hedging demand pulls the currency position toward the currency in which the liabilities are denominated, which for ATP is the krone. Because ATP's guaranteed pensions

⁹³Viceira and Shen (2026) find that deviations from covered interest parity have little effect on risk-minimizing currency demands: bond investors should generally hedge their currency exposures, while equity investors can benefit from retaining exposure to currencies such as the dollar and the euro. By contrast, persistent deviations from uncovered interest parity can generate expected-return-driven currency positions large enough to offset, and sometimes reverse, those risk-minimizing demands.

are krone-denominated and bond-like, the liability that has to be matched carries essentially no foreign-currency sensitivity of its own. This demand therefore reduces, in ATP's case, to the statement that the neutral, liability-matching position is the fully krone-hedged one, with the euro treated as a second home currency through the peg. Holding some foreign currency would be called for only if the liabilities had genuine foreign-currency sensitivity, such as real, imported-inflation exposure; absent that, the liability-driven and asset-only positions nearly coincide.

The risk-minimizing demand depends on how a currency co-moves with the assets it accompanies, and here the dollar behaves distinctively for a krone investor. A currency adds portfolio risk, and is worth hedging, when it tends to weaken against the krone just as the asset falls; it reduces risk, and is worth holding, when it does the opposite. The strength of the demand rises with the asset's volatility and with the correlation, and falls as the currency's own volatility increases. The decisive case is the US dollar. From a krone standpoint it tends to be a safe haven, appreciating in risk-off episodes when global equities fall, so its return correlates negatively with equity risk. That negative correlation reverses the usual sign: risk minimization implies that a krone investor should hold part of its dollar exposure behind equities as a hedge, deliberately under-hedging it, rather than hedge it away.

The same logic differs sharply between equities and bonds, for two reinforcing reasons. First, currency is a much larger share of a foreign bond's risk than of a foreign equity's: a government bond has low volatility in its own (local) currency, so most of an unhedged foreign bond's variance is currency, whereas an equity's local volatility dominates its total volatility, which counts both local equity returns and currency returns. Second, the correlation flips sign, because the dollar hedges equity risk but not bond risk: US Treasuries and the dollar are both safe assets that tend to rally together in a flight to quality. Both forces point toward hedging the currency of a foreign bond heavily and that of a foreign equity only lightly, holding part of it where the currency is a safe haven. This is the theoretical counterpart of the empirical pattern in the previous section, in which fixed income is hedged far more than equity and non-dollar investors more than dollar investors.

The speculative demand responds to expected currency excess returns, harvesting the risk premiums in foreign exchange. These premiums are time-varying and are usually captured through carry, momentum, and value strategies (see, for example, [Asness, Moskowitz, and Pedersen, 2013](#); [Kojen et al., 2018](#)), which have historically delivered significant Sharpe ratios. The premiums are arguably compensation for risk, however, and part of that risk is unpriced, or uncompensated ([Chernov, Dahlquist, and Lochstoer, 2023](#); [Chernov, Dahlquist, and Lochstoer, 2026](#)), so the strategies are best run in a deliberately risk-managed way rather than with a static, open

currency position. ATP accesses this demand accordingly, as active carry and momentum positions inside the Other factor, sized to a limited risk budget.

Taken together, the three demands imply a high optimal hedge ratio for fixed income and a lower one for equities, with the portfolio-level position depending on the asset mix. For a foreign bond, all three demands push toward a near-full, or even greater-than-full, hedge. For a foreign equity in a safe-haven currency such as the dollar, both risk minimization and the speculative demand argue for holding part of the currency, so the stand-alone optimum can sit below 100 pct. Because the sleeve-by-sleeve positions aggregate according to the equity/bond mix, an equity-heavy portfolio retains more dollar exposure than a balanced, bond-heavy one. The single-asset theory therefore leaves room to hedge some currencies below 100 pct; how much of that room is worth using, once the whole portfolio, the expected-return give-up, and the costs of hedging are taken into account, is addressed next.

Analysis for ATP's portfolio

With hindsight, we can see that hedging a foreign investment back to kroner has paid off for some currencies and been costly for others, and that the stand-alone case for hedging has differed markedly across currencies and asset classes. Over 1994–2025, short-forward (hedged) positions in the US dollar and the Australian dollar were penalized, while hedging the yen was substantially rewarded. The pattern also depends on the asset: on a stand-alone basis, under-hedging US equities and over-hedging Japanese bonds would both have paid off, and Japanese bonds in particular were very attractive to hedge, raising returns and roughly halving volatility in kroner. Bonds are also more efficiently hedged than equities, because the forward contract co-moves much more tightly, and more negatively, with the return on foreign bonds in kroner than with equities. Read at face value, and assuming history repeats, these patterns would argue for hedge ratios below 100 pct on some assets, such as US and Australian, and at or above 100 pct on others, such as Japanese.

Taken in a portfolio context rather than asset by asset, the case for hedging strengthens for a diversified, risk-based investor. A currency position that looks attractive to hold on its own may add little diversification to an already well-diversified portfolio, so it has to compete with everything else for the risk budget. Exhibit 7.73 illustrates this for a stylized global equity-bond portfolio: the Sharpe-ratio benefit from fully hedging all foreign exposures is large when the equity weight is around 30 pct, lifting the Sharpe ratio from roughly 0.55 unhedged to more than 0.80 fully hedged, whereas an all-equity investor is better off not hedging at all. The more balanced, and bond-heavy, the portfolio, the harder it is to justify running open currency risk.

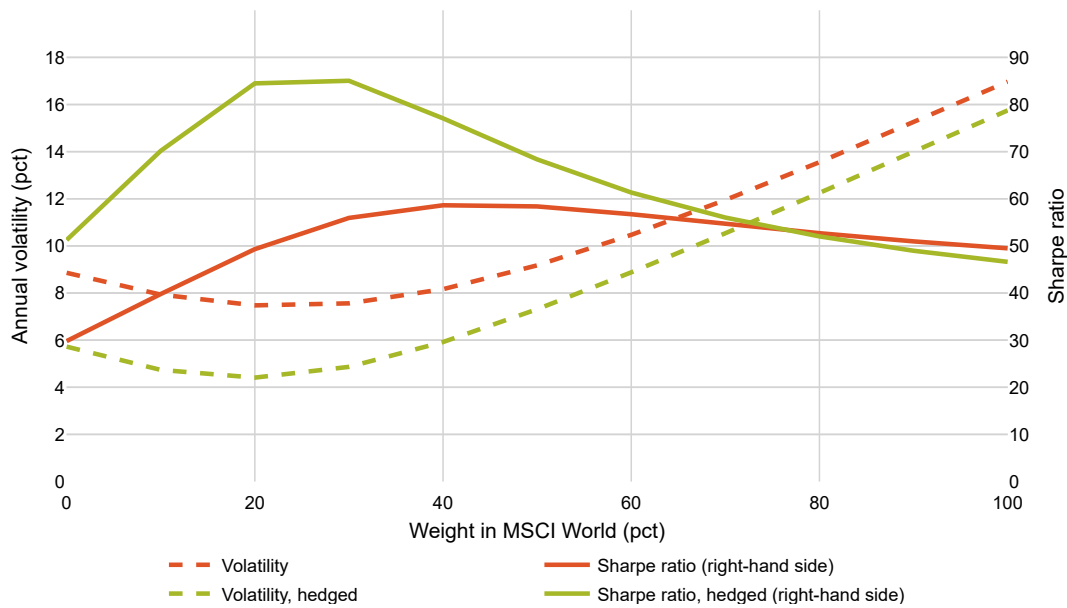


Exhibit 7.73: Sharpe ratio and volatility as a function of the weight in global developed-market equities. The figure shows an illustrative global equity-bond portfolio, fully hedged to kroner versus unhedged, with the Sharpe ratio and volatility in kroner plotted as the weight in global developed-market equities varies. Data are monthly, December 1994 to December 2025, the longest span for which comprehensive forward-rate data are available.

The distinction that matters for ATP is between a balanced-beta portfolio and a conventional 60-40 portfolio. Exhibit 7.74 plots the Sharpe ratio against a uniform hedge ratio for two portfolios built from the same assets: a balanced-beta portfolio with about 30 pct in developed-market equities, tilted toward equal weights, and 70 pct in equal-weighted European, US, and Japanese long-dated government bonds; and a market-cap-weighted 60-40 portfolio. The 60-40 portfolio's Sharpe ratio is largely insensitive to the hedge ratio between 0 and 100 pct, but the balanced-beta portfolio is much more sensitive, and its optimal hedge ratio is around 100 pct. Because the balanced-beta portfolio holds a large weight in bonds, including Japanese bonds whose currency is very efficiently hedged, leaving currency risk open is simply not rewarded.

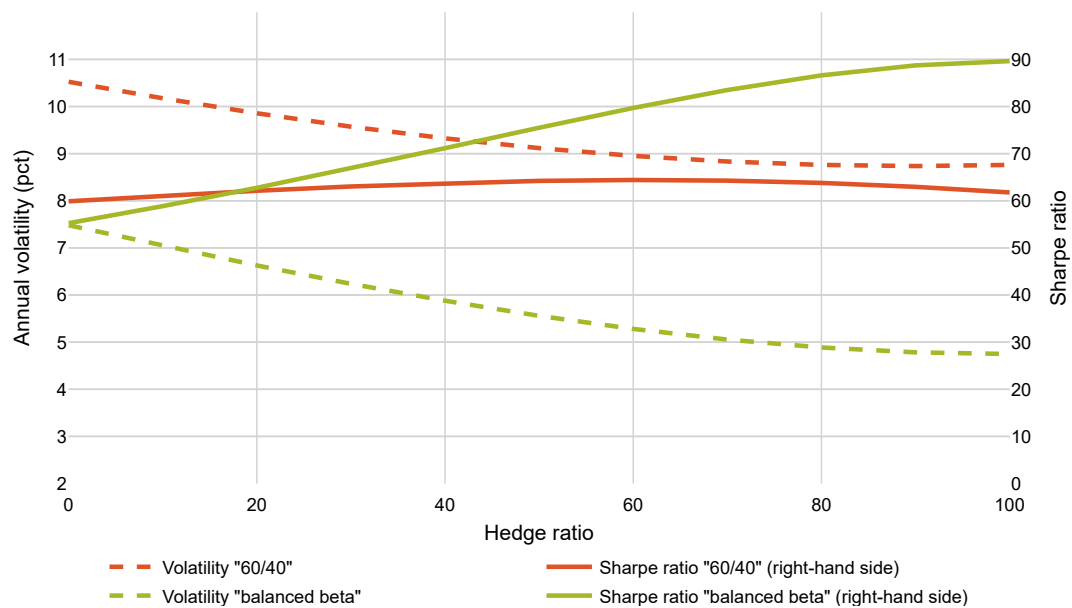


Exhibit 7.74: Sharpe ratios and volatilities in a balanced-beta portfolio and a 60-40 portfolio as a function of the universal hedge ratio. The figure shows the Sharpe ratio and volatility of a balanced-beta portfolio and a market-cap-weighted 60-40 portfolio, built from the same assets, as the universal hedge ratio varies from 0 to 100 pct. Data are monthly, December 1994 to December 2025, the longest span for which comprehensive forward-rate data are available.

For a balanced-beta investor such as ATP, the portfolio-level analysis therefore points toward substantially more hedging than for a 60-40 investor. ATP holds more fixed income, and a more equally weighted allocation, than a cap-weighted 60-40 portfolio (see Section 6.3.4), which is precisely the configuration in which full hedging is most valuable, and the result is consistent with ATP's own balanced-beta analysis, which finds the Sharpe-optimal universal hedge ratio close to 100 pct. Two caveats apply: the results are sensitive to the sample period, the portfolio composition, and above all the correlations that drive them; and even for a balanced-beta investor, a hedge ratio away from 100 pct on individual currencies, such as holding some of the safe-haven dollar behind equities, can still be optimal. We weigh these considerations in the evaluation.

Hedging costs

When practitioners call hedging costly, they usually mean two different things, only one of which is a cost in the ordinary sense. The forward exchange rate embeds the interest-rate differential between the two currencies, but that differential is a fair, no-arbitrage price rather than a charge: it is fixed by covered interest parity so that no riskless profit is available. Because US interest rates have typically exceeded Danish and euro rates, the dollar stands at a forward discount, so hedging it—selling dollars forward—locks in fewer kroner than the spot rate and gives up the dollar's yield advantage. That give-up is real and can be sizeable, but it

is compensation embedded in a fair price rather than a charge: whether it actually lowers the position's expected excess return depends on how much the dollar is expected to depreciate over the hedge, which is embedded in the currency risk premium, and is not a fee paid to a counterparty to arrange the currency transaction. Hedging does change the expected excess return of a position, but only relative to the expected future exchange rate, and that effect is the currency risk premium already discussed under the speculative demand above. The genuine costs of hedging are the frictions that sit on top of the fair forward price, and for ATP they are modest.

The most familiar friction, the bid-ask spread on foreign exchange transactions, is small for an investor like ATP. Forward spreads on the major (G10) currencies are tight, the FX swaps used to roll hedges are tighter still, and large institutions trade well inside the indicative spreads quoted to smaller counterparties (well documented since at least [Bessembinder, 1994](#)). Realistic bid-offer spreads on the major currencies are modest and do not overturn the economics of currency positions, with the larger costs confined to less liquid, non-G10 currencies that are not central to ATP's hedging (see, for example, [Gilmore and Hayashi, 2011](#); [Chernov, Dahlquist, and Lochstoer, 2026](#)). Rolling a hedge in the deep dollar and euro markets is inexpensive.

The one genuine and economically significant friction is the cross-currency basis, a post-crisis feature of dollar hedging. The basis is a wedge on top of the fair covered-interest-parity price: since the 2008 crisis synthetic dollar funding has been persistently expensive, so for a non-US investor the dollar forward is priced such that hedging the dollar carries a small premium ([Du, Tepper, and Verdelhan, 2018](#)).⁹⁴ It is a friction rather than a fair price because it is not implied by any no-arbitrage relationship; it exists likely because the banks that intermediate the hedges are balance-sheet constrained, and heavy hedging demand itself widens it. Two features matter for ATP. First, it is a dollar phenomenon: the basis is significant only against the US dollar and is less relevant between two non-dollar currencies, so for a krone investor, whose euro exposure is quasi-domestic, it bears only on the dollar. Second, it is small: the basis on the dollar has averaged about 0.25 pct, and although the krone/dollar basis is wider, most dollar hedging is routed through the euro, whose basis is close to that average. Across the whole institutional hedging portfolio, the aggregate is nonetheless large, with [Du and Huber \(2026\)](#) estimating about USD 2.7 billion a year for the insurance and pension sectors combined,

⁹⁴The cross-currency basis is visible in quoted cross-currency swaps, which exchange, for example, a three-month krone interest rate for a three-month dollar rate over a set horizon such as five years. Because cash flows in two currencies are exchanged, markets clear only if one side pays a premium to obtain funding in the more sought-after currency (the dollar) rather than the less sought-after one (the krone). The same basis is visible in quoted forward exchange rates, tilting the tradable forward away from the "textbook" forward implied by the interest-rate differential (covered interest parity). Depending on its sign, an investor hedging via an FX forward is either helped or penalized relative to the parity-implied forward. Taking the exposure through a derivative avoids the cash exchange of currencies and so most of the basis; any funding cost embedded in the derivative, for example through margin rules, is typically smaller than the krone/dollar basis.

reflecting the volume of hedging rather than a high price per investor.

ATP can avoid most of the basis through the way it takes on dollar exposure. Because a large part of its foreign exposure is implemented through derivatives rather than by buying the cash asset and hedging it with an FX forward, ATP does not pay the cross-currency basis on that part of the portfolio, the point already noted above in describing how ATP hedges. The savings are not complete, however. The same balance-sheet constraints that widen the basis also make dealers charge for financing derivative positions, and that funding cost is passed into the prices they quote (Andersen, Duffie, and Song, 2019), so part of it reappears in the price of the derivatives themselves, and it does so across the largest futures markets. The implied financing rate in bond and other interest-rate futures has traded persistently above the risk-free rate, widening around quarter- and year-ends (Fleckenstein and Longstaff, 2020); and equity index futures show a comparable wedge in their implied financing rate, one that moves with net investor demand for futures exposure and the balance-sheet costs of the dealers who absorb it (Hazelkorn, Moskowitz, and Vasudevan, 2023). Because ATP takes much of its dollar exposure through these types of instruments, part of the funding cost it avoids in the FX-swap market re-emerges here. In effect ATP swaps the currency basis for a derivative-financing spread, and which of the two is cheaper varies over time and across instruments. Where it does hedge cash assets with forwards, routing the dollar hedge through the more liquid euro market further limits the cost. The basis is therefore a genuine but largely avoidable cost for ATP, and a smaller drag than for peers that hedge cash bond portfolios directly with dollar forwards.

The remaining costs are operational: the overhead, collateral, and the margin and liquidity demands of running a large hedging portfolio. We do not evaluate these separately here, since they are the ordinary costs of any derivatives-based strategy and are covered in the report's assessment of how ATP implements leverage and manages the associated margin and liquidity needs (Sections 6.6 and 7.7.1). For the currency hedge in particular, they do not change the conclusion that the direct costs of hedging are relatively small.

Evaluation

We regard ATP's policy of hedging close to 100 pct of its non-euro foreign-currency exposure as well-founded. Hedging the currency risk in the liabilities is straightforward, since the guarantees are krone denominated. Fully hedging its large fixed-income allocation also makes clear sense, because currency is most of a foreign bond's risk and adds little diversification. The one place where a lower hedge ratio could be argued on a stand-alone basis is equities in safe-haven currencies, notably the US dollar, which a krone investor might partly hold as a hedge in equity downturns. For ATP, however, the argument is weak: with a fixed-income-heavy, balanced-beta portfolio, the diversification value of an open dollar position is small, and a

hedge ratio close to 100 pct is appropriate.

One cost of a fully currency-hedged portfolio is that it makes ATP look very different from its peers. Most institutional investors, including ATP's Danish pension peers, leave a much larger part of their foreign currency exposure unhedged—so ATP's near-complete hedge sits at the top of the range. Thus, ATP will lag behind less-hedged peers when the currencies they hold appreciate against the krone, especially when the US dollar rallies. Since the dollar tends to strengthen in risk-off episodes, this shortfall shows up in equity downturns when peers with a less currency-hedged portfolio would experience a gain from currency positions that ATP forgoes. The opposite—when the krone strengthens against the USD—tends to draw less attention. This large tracking error, or peer risk, does not make ATP's policy economically unsound—in fact, we agree with a policy of hedging close to 100 pct for ATP—but it exerts a large burden to explain and maintain the policy through periods where an unhedged currency position leads to ATP lagging its peers.

Where ATP does want currency exposure, it is better taken as a separate, deliberate position than as a standing deviation from full hedging. ATP does this through the Other factor, and it fits the return-based framework we recommend in the conclusions and recommendations (Section 10.4.7). The reason for this is that currency risk premiums are time-varying: a constant over- or under-weight of a currency is an inefficient way to harvest them, whereas an active, dynamically sized position can respond to when the premium is actually on offer.

Finally, because the cross-currency basis and the cost of financing derivative positions can be material, how ATP implements its hedges matters as much as the target ratio. Accessing dollar exposure through derivatives, and routing forward hedges through the more liquid euro market, both reduce this cost, though neither eliminates it. We therefore see continued attention to the most cost-effective implementation as an integral part of the hedging policy rather than a purely operational detail.

7.7.6 New business model

Key message

The new business model can raise expected pensions and stabilize ATP's risk-taking, but it does so by accepting a deliberate increase in the risk that ATP cannot honor its guarantees—and its success depends on the Supervisory Board's ability to hold the course through losses.

The new model can deliver the same 2 pct inflation indexation at a lower required return on the Investment Portfolio. ATP has chosen not to take this benefit as lower risk;

Key message (continued)

instead, it keeps investment risk unchanged and uses the model to increase the likelihood of meeting the indexation target.

The new model can also deliver a more stable risk level across market conditions. As the funding ratio falls toward 100 pct, the equity-equivalent allocation declines by about 40 pct under the new model, against about 60 pct under the old one.

These benefits come at a cost: the model roughly doubles the 10-year probability of technical insolvency, from 0.3 pct to 0.6 pct. The level remains low, and the figures reflect relative rather than absolute risk (they allow for management action and exclude the harsher Solvency II scenarios). But the increase represents a deliberate break with ATP's guarantee-based model, and the guarantee is ATP's central contribution to a Danish pension system that is otherwise moving toward market-based products.

The construction rests on one presumption: that ATP's Supervisory Board can stay the course. The Supplementary Hedge Portfolio only works if losses are allowed to accumulate rather than being realized early. Should the Supervisory Board realize losses prematurely—or be replaced by one that does—the mechanism fails. Management has a standing obligation to keep the Supervisory Board aware of the risks and requirements of this design.

The new business model introduces two main elements: the Variable Annuity and the amended hedging strategy, with two new related portfolios—the Market Return Portfolio (M) and the Supplementary Hedge Portfolio (SAP). (See Section 5.5.6). The new portfolios serve different purposes than the Interest Rate Hedge Portfolio and the Investment Portfolio. First, the new portfolios are first assessed in relation to their impact on required returns, risk levels and dynamic risk exposure. Second, the changes are viewed with members in mind and the expected pension and pensions at risk. Finally, the changes are assessed in terms of their potential downsides and the demands they will put on ATP's Supervisory Board when their performance is poor.

Role of the Long-term Supplementary Reserve and Life Annuity with Market Exposure for required returns and risk level

The introduction of the new business model has a profound impact: it changes the required return on the Investment Portfolio. The ability of ATP to pay bonuses is dependent on the health of ATP being sufficient to transfer funds from the Bonus Potential to the members' pensions. The health is typically defined through the funding ratio and discussed in detail in Sec-

tions 5.4.6 and 7.4.3. With the changes in the business model, the funding ratio is expected to increase further due to expected positive returns on the Supplementary Hedge Portfolio (SAP) and subsequent transfers from the Long-term Supplementary Reserve (LSH) to the Bonus Potential (BP). On the other hand, the pension liabilities are expected to grow faster (and thus the funding ratio slower), due to higher expected returns on the Variable Annuity.

Without the introduction of the new business model, required excess return on the Investment Portfolio is 16.5 pct before tax, see Section 6.4.1. This calculation relied on a linear approximation. A more accurate calculation which leads to a required excess return of 16.7 pct.

If the sole purpose of the Supplementary Hedge Portfolio was to change the dynamic risk profile—and not to add to overall risk—the risk level in the Investment Portfolio could be lowered. First, we consider the impact of adding risk in the Supplementary Hedge Portfolio and how it impacts the return needed to meet a 2 pct indexation target. Exhibit 7.75 illustrates the impact on this required return. The cell in the upper left corner shows a required return of 16.7 pct which is the more accurate version of the calculations in Section 6.4.1. With the current risk budget of 2.5 pct in the Supplementary Hedge Portfolio, the required return decreases from 16.7 pct to 12.3 pct and the required risk from 55 pct to 41 pct (equivalent to lowering the annualized volatility from 42 pct to 31 pct).

Exhibit 7.75: Required excess return and risk before tax on the Investment Portfolio as a function of risk in the Supplementary Hedge Portfolio, given that the reserve for the Life Annuity with Market Exposure (H_m) has a zero share of pension liabilities. It is assumed that the risk premium in the term structure of interest rates is 1 pct and that long-run inflation is 2 pct. Note that the required risk calculation is sensitive to the assumed market price of risk (or Sharpe ratio) in the Risk-seeking Portfolios. The baseline case is a Sharpe ratio of 0.4, which in historical terms can be considered conservative. For convenience, the required risk level with a more optimistic baseline of 0.45 is also shown (historically, the Sharpe ratio has been at least 0.65).

Risk in SAP (pct)	0.0	0.5	1.5	2.5	3.5
Required excess return (pct)	16.7	15.8	14.0	12.3	10.6
Required ES(99 pct, 3M) (pct)	55	52	47	41	35
Required annualized volatility (pct)	42	39	35	31	26
Required excess return (@ 0.45 Sharpe ratio) (pct)	16.7	15.7	13.7	11.8	9.8
Required ES(99 pct, 3M) (@ 0.45 Sharpe ratio) (pct)	49	46	41	35	29
Required annual. vol. (@ 0.45 Sharpe ratio) (pct)	37	35	30	26	22

The Life Annuity with Market Exposure increases the required return, but the actual impact will depend on realized returns. Exhibit 7.76 illustrates the effect of introducing the Life Annu-

ity with Market Exposure, holding the risk level in the Supplementary Hedge Portfolio fixed at 2.5 pct. For example, moving from a zero to a 5 pct share of liabilities increases the required return and ES risk by 0.4 pct and 1 pct, respectively. The reason for this is that the reserve for the Life Annuity with Market Exposure (HM) is bonus eligible and the expected excess return over the interest rate guarantee in the Market Return Portfolio increases the bonus required to index pension rights with inflation. However, the higher required return is driven solely by the assumption that HM is expected to grow more than the Interest Rate Hedge Portfolio and thereby make up a bigger share of the pension liabilities. Note that bonuses to HM will eventually become pensions and increase expected pensions by more than had they been allocated to the Interest Rate Hedge Portfolio. Finally, the changes in the required risk levels are smaller than those from changing the risk levels in the Supplementary Hedge Portfolio.

Exhibit 7.76: Required excess return and risk before tax on Investment Portfolio as a function of different sizes of H_m , given a risk level of 2.5 pct in the Supplementary Hedge Portfolio. We assume that the risk premium in the term structure of interest rates is 1 pct and that long-run inflation is 2 pct. Note, that the required risk calculation is sensitive to the assumed market price of risk (or Sharpe ratio) in the Risk-seeking Portfolios. The baseline case is a Sharpe ratio of 0.4, which in historical terms can be considered conservative. For convenience, the required risk level with a more optimistic baseline of 0.45 is also shown (historically, the Sharpe ratio has been at least 0.65).

H_m share of pension liabilities (pct)	0	5	10	15	20
Required excess return (pct)	12.3	12.7	13.2	13.6	14.0
Required ES(99 pct, 3M) (pct)	41	42	44	45	47
Required annualized volatility (pct)	31	32	33	34	35
Required excess return (@ 0.45 Sharpe ratio) (pct)	11.8	12.2	12.7	13.2	13.7
Required ES(99 pct, 3M) (@ 0.45 Sharpe ratio) (pct)	35	36	38	39	41
Required annual. vol. (@ 0.45 Sharpe ratio) (pct)	26	27	28	29	30

The required return and the risk level decline with higher—but not unrealistic—Sharpe ratios. Both Exhibits 7.75 and 7.76 include calculations based on a slightly more optimistic Sharpe ratio on the Risk-seeking Portfolios. Increasing Sharpe ratio to 0.45, the required return and ES-risk under the new business model and current balance sheet drop to 11.8 pct and 35 pct, respectively. As these Sharpe ratios are realistic, but the range is uncertain, one can conclude that required return is within the vicinity of 12 pct and required ES-risk in the 35 pct to 40 pct range. This is where ATP is currently operating.

Role of the Long-term Supplementary Reserve and Life Annuity with Market Exposure for the dynamic risk profile

The dynamic risk profile also changes with the new business model, as a larger part of the investment risk is linked to the pension liabilities and not just the Bonus Potential. The implementation of both the Long-term Supplementary Reserve and the Life Annuity with Market Exposure implies that the risk taken by ATP, to a larger extent, is based on the total AuM, rather than just the Bonus Potential. A simple way to illustrate the dynamic risk exposure in ATP's business model is to calculate the total equity equivalent allocation as a percentage of AuM, given a fixed level of the funding ratio. This can demonstrate the combined effect of risk in the Investment Portfolio, the Supplementary Hedge Portfolio, and the Market Return Portfolio (which is currently very small).

In the old business model, the total equity equivalent allocation had to fall considerably when the funding level declined. The red line in Exhibit 7.77 shows the equity equivalent equity allocation under the "old" business model, which means there are no Supplementary Hedge Portfolio or Market Return Portfolio, with a risk consumption in the Investment Portfolio of 40 pct. Starting at a funding ratio at 120 pct, the equity equivalent allocation is reduced from 33 pct to 13 pct. When the funding ratio is 100 pct, there is a relative decrease of around 60 pct.

Under the new business model, the equity equivalent allocation falls less as the funding ratio declines. The green line shows the calculation under the new business model using the current small share of the Market Return Portfolio. Consistent with the intention to increase total risk in the pension product, rather than only change its risk profile, the equity-equivalent allocation rises from 33 pct to 45 pct after the introduction of the Supplementary Hedge Portfolio, with only a negligible effect from the Market Return Portfolio. Moving along the green line down to a funding ratio of 100 pct, the equity allocation drops to 27 pct, that is, a relative drop of 40 pct. Thus, introducing the new business model means a more stable risk consumption (60 pct drop versus 40 pct) across the funding ratio and hence across market scenarios.

If the sole purpose of the Supplementary Hedge Portfolio was to change the dynamic risk profile—and not add overall risk—then the risk budget would have been even more stable. This is shown in the blue line. Here, the risk budget in the Investment Portfolio is calibrated such that the total risk, after introducing the new business model, is unchanged. The equity allocation shifts from 33 pct to 27 pct, that is, a relative decrease of 20 pct.

Review of ATP's Investment Strategy

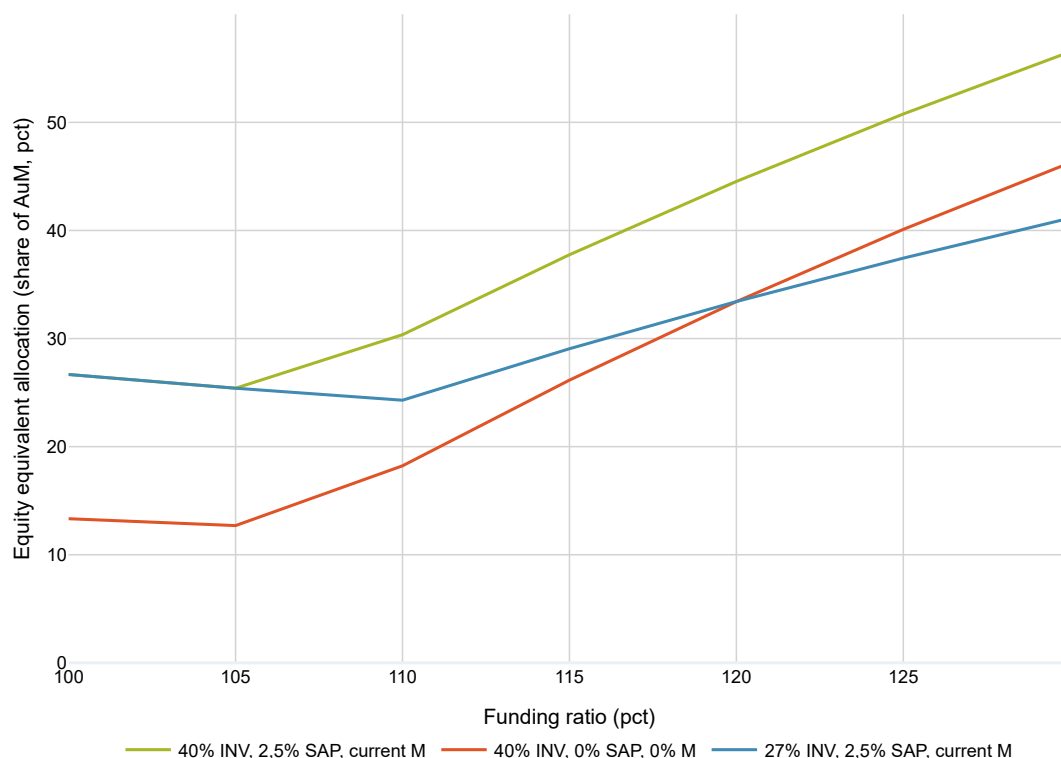


Exhibit 7.77: Equity equivalent allocations relative to AuM as a function of funding ratio. The red line shows the equity equivalent equity allocation under the “old” business model with a risk consumption in the Investment Portfolio of 40 pct, that is, both the Supplementary Hedge Portfolio and the Market Return Portfolio have zero risk. The green line is calculated under the assumption that risk consumption in the Investment Portfolio is 40 pct, 2.5 pct in the Supplementary Hedge Portfolio and 16 pct in the Market Return Portfolio on the balance sheet at December 31, 2025. The blue line is calculated under the hypothetical assumption that risk is 2.5 pct in the Supplementary Hedge Portfolio and 16 pct in the Market Return Portfolio on the balance sheet at December 31, 2025, but where risk consumption in the Investment Portfolio is calibrated such that the introduction of new business model did not change the total risk consumption, but only shifted it from the Investment Portfolio to the Supplementary Hedge Portfolio.

Irrespective of whether the new business model was introduced or not, ATP's investment strategy could be considered a hybrid between CPPI-like insurance and constant mix, but with most of the weight on CPPI. (For CPPI strategies, see Section 4.1.6.) After the introduction of the new business model, the weight on the constant mix is increased and ATP shifts more towards being a hybrid investor. If ATP had chosen not to increase risk, one could possibly argue that ATP would be more like a constant mix investor than a CPPI investor. The new business model does provide a more stable risk budget.

Risks in the new business model

The new business model adds more risk and complexity to ATP's business model. It poses significant additional requirements on the capacity of the ATP Supervisory Board to withstand pressure, as it must be able to keep the risk in the Supplementary Hedge Portfolio even when losses are significant. Finally, it increases the risk that ATP will be technically insolvent, with

potential losses to the guarantee; the 10-year probability increases from 0.3 pct to 0.6 pct (see also Section 7.4.2 and Exhibit 7.8 which compare the impact of different risk levels in the Investment Portfolio). These percentages are calculated allowing for management action and not the harsher scenarios of Solvency II. Therefore, they should primarily be seen as an indication of the relative risks in the two business models, that is, the risks double in the new business model.

The complexity largely comes from the Supplementary Hedge Portfolio, whereas the Market Return Portfolio is simple. The Market Return Portfolio is a much simpler construction than the Supplementary Hedge Portfolio, and losses in the Market Return Portfolio will not have an impact on the guarantees. The Market Return Portfolio can create more volatile pensions through market exposure. However, for the members with little or no exposure to risky assets, for example, those who do not have occupational pensions or do not own stocks themselves, this is an exposure that improves welfare (see, for example, [Dahlquist, Setty, and Vestman, 2018](#)). It seems politically fair that other members can tolerate this change from a pure guaranteed product. The complexity from the Supplementary Hedge Portfolio results from profits and losses that are not transferred immediately to the Bonus Potential. This is an accounting feature that in bad times allows losses to accumulate.

When losses in the Supplementary Hedge Portfolio accumulate, ATP's Supervisory Board could come under considerable pressure. The presumption is that ATP's Supervisory Board can stay the course. If ATP's Supervisory Board decides to realize the losses early, the Supplementary Hedge Portfolio will not work as intended. If ATP's Supervisory Board is replaced because of the losses, experience suggests that the first thing a new Supervisory Board will do is to realize losses and blame them on their predecessors. Daily management has a standing obligation to make the Supervisory Board aware of the risks and requirements of the Supplementary Hedge Portfolio construction. Section 7.4.2 also mentions this scenario, and presents expected recovery on the guarantees if a new Supervisory Board does an orderly or disorderly revocation of the new business model in this scenario.

Because ATP is a systemically important, guarantee-based fund, its risk-taking should be held to a conservative standard. ATP plays a crucial role as a Pillar 1 fund, and the risks it runs should reflect that role and the guarantees it has made. Although ATP is not subject to Solvency II—and should not be—Solvency II provides an internationally respected reference point for the level of risk appropriate to pension funds and life insurers. It is an imperfect benchmark, with caveats and compromises, but Denmark has generally chosen to stay on its safe side, and ATP should continue to do so.

The added risks from the new business model to ATP fully meeting its guarantees may seem

small, but they represent a break with ATP's unique business model. Exhibit 7.78 presents the impact of different risk levels in the Investment Portfolio, but also in the Supplementary Hedge Portfolio, on approximate Solvency II capital ratios. The exhibit is comparable to Exhibit 7.9 in Section 7.4.2. Without risk in Supplementary Hedge Portfolio, the approximate Solvency II capital ratio falls from 149 pct to 140 pct as the funding ratio drops from 120 pct to 110 pct. With Supplementary Hedge Portfolio risk in the portfolio, an isolated shock to the funding ratio does not change the capital ratios. However, in the more likely scenario where the Supplementary Hedge Portfolio also has negative returns in Panel (c), the capital ratios go from 140 to 116 at the current risk levels for the Supplementary Hedge Portfolio. A higher risk level would lead to capital ratios below 100 pct, if more risk was added in either the Supplementary Hedge Portfolio or the Investment Portfolio.

The new business model thus increases the likelihood that ATP cannot honor its guarantees. At 50 pct risk in the Investment Portfolio, the probability of technical insolvency (a negative Bonus Potential) is 0.10 pct. This likelihood is not large at first glance, and the argument is that ATP can increase expected pensions as shown above, including with a more stable investment allocation through the Supplementary Hedge Portfolio. It could be argued that all pension funds run risks that they cannot honor their guarantees. However, the unique element in the new business model is that this is part of a deliberate design and comes on top of unchanged risk-taking in the Investment Portfolio. Furthermore, one of ATP's key contributions, and a central area of differentiation in the Danish pension system—which is increasingly moving toward market-based funds with a larger share of equities—is the guarantee it provides.

Exhibit 7.78: Approximate Solvency II Capital Ratios for different risk targets under the implementation of the new business model. ATP is not under Solvency II regulation. However, the table calculates a hypothetical approximate Solvency II capital ratio as a function of an applied risk level in the Investment Portfolio (INV) and the Supplementary Hedge Portfolio (SAP). Panel (a) approximates ATP's current situation, while Panel (b) assumes a situation where ATP is under a stressed scenario, where severe losses have been realized and the funding ratio has dropped to 110 pct. Panel (c) adds losses in the Supplementary Hedge Portfolio, such that risk bearing capacity of the Long-term Supplementary Reserve (LSH) drops by 75 pct. The difference between Panel (b) and Panel (c) is whether the risk in the Supplementary Hedge Portfolio can be absorbed within LSH, or whether it will impact the Bonus Potential. The calculations include capital requirements for longevity risk as a constant share of Guaranteed Benefits, and operational as well as counterparty risk as a constant share of AuM. The calculations use ATP's internal risk model, not the Solvency II standard model.

Risk in SAP (pct of GY)	40 pct risk in			50 pct risk in		
	Investment Portfolio			Investment Portfolio		
	0.0	2.5	3.5	0.0	2.5	3.5
Panel (a): Funding ratio = 120 pct						
Risks after market risk and longevity (pct)	35	35	35	43	43	43
Risk consumption (pct of Board maximum)	69	69	69	86	86	86
Solvency II approximate Capital Ratio (pct)	149	149	149	120	120	120
Implicit probability of technical insolvency (pct)	0.01	0.01	0.01	0.10	0.10	0.10
Panel (b): Funding ratio = 110 pct						
Risks after market risk and longevity (pct)	37	37	37	45	45	45
Risk consumption (pct of Board maximum)	74	74	74	90	90	90
Solvency II approximate Capital Ratio (pct)	140	140	140	115	115	115
Implicit probability of technical insolvency (pct)	0.02	0.02	0.02	0.15	0.15	0.15
Panel (c): Funding ratio = 110 pct, LSH drops to 1/4 in size						
Risks after market risk and longevity (pct)	37	45	52	45	53	60
Risk consumption (pct of Board maximum)	74	89	104	90	105	121
Solvency II approximate Capital Ratio (pct)	140	116	99	115	98	85
Implicit probability of technical insolvency (pct)	0.02	0.14	0.54	0.15	0.58	1.39

7.7.7 Peer comparisons

Key message

ATP has no natural peer, so any comparison must be read with care: the relevant benchmark depends on the question, and differences in role, product, and strategy can make headline comparisons misleading. With that caveat, the comparisons are still informative, and they point in different directions depending on the peer.

Key message (continued)

Against Danish market-rate products, ATP's raw investment-portfolio return has been high—11.4 pct per year over 2015–2025—but this largely reflects a higher risk level. On a risk-adjusted basis, ATP outperformed these peers up to 2022 but underperformed thereafter. ATP's medium-risk Market Return Portfolio has underperformed comparable products since its 2022 launch.

ATP ranks around top third in the considered peer group when comparing the wealth accumulation of ATP to the Danish life insurers and occupational pension funds since 2001. However, since 2015 ATP ranks in the very low end. The comparison does not represent an “apple-to-apple” comparison as it is simply not possible to make a 100 pct fair comparison between the peers in the Danish pension industry.

Against international risk parity investors (ATP's closest peers by investment approach) ATP has done better, generating a higher risk-adjusted return than most of the foreign asset managers, though below an all-equity or 60-40 portfolio. Across all these comparisons, the statistical uncertainty is high, so individual rankings should not be over-interpreted.

ATP often attracts public interest which is natural given its coverage of most of the Danish population as members and due to the status as a statutory pension fund. The public attention has not been dampened in recent years especially after the large investment loss in 2022 and a couple of challenging years thereafter.

Peer comparisons by journalists or academics have become more normal among the Danish pension funds and these also include ATP. Since market-rate products have become dominant in Denmark, it has become easier for members to identify their own individual pension returns and the development of their personal pension account. Hence, return and performance comparisons between these products are also performed and revealed to the public. However, ATP cannot be compared directly to a market-based Danish pension fund due to ATP's different role in the Danish pension system and its different pension product and investment strategy.

Given ATP's role, product, and strategy, there is not a natural “single” peer. Instead, many different types of institutional investors can constitute ATP's peers, depending on the setting. For example, the Norwegian Government Pension Fund Global (GPFG) is an investor that is sometimes used as “comparable” or “similar” to ATP, likely due to the status as a large, public and Scandinavian investor. However, there are more differences than similarities between the GPFG and ATP.

Exhibit 7.79 reports an extract of large international institutional investors by characteristics like type, role, liabilities, and whether they have members or not. No investor shares all the same characteristics as ATP (and that would still be the case even if the table was expanded with many additional investors). Besides being different in size, the main difference arises from the investors' role and composition of liabilities, which range from pension funds with guarantees, market-rate products, or defined benefit (DB) and defined contribution (DC) schemes, to sovereign wealth funds, reserve managers, and asset managers with no explicit liabilities.

Based on the liabilities, ATP's closest peers are some of the Danish pension funds with guaranteed products (for example Pension Fund for Teachers or PKA). The Dutch funds ABP and PFZW also have similarities with their DB schemes, although they are currently converting, or about to convert, to DC schemes. Based on the investment strategy for the Risk-seeking Portfolios, ATP's closest peers are the risk parity asset managers AQR and Bridgewater.

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Exhibit 7.79: ATP peers as of year-end 2025. The table shows large institutional investors that can be categorized as peers for ATP. They are compared by country, investor characteristics (type, role, and kind of liabilities), AuM (in EUR billion), and number of members (in million). For the Danish pension funds, the reported AuM in the table is given by the size of provisions to the members and any equity. Source: Annual reports from 2025 for the different funds.

Name	Country	Liabilities	AuM (EUR billion)	Members (million)
Statutory Pension Fund				
ATP	DK	Guaranteed Lifelong Pensions	93	5.8
Occupational Pension Fund				
PFA	DK	Mainly market-rate	100	1.3
Danica	DK	Mainly market-rate	71	0.75
Velliv	DK	Mainly market-rate	40	0.42
PKA	DK	Guarantees	49	0.37
Pension Fund for Teachers	DK	Guarantees	21	0.17
ABP	NL	Defined Benefit (DB)	533	3.2
PFZW	NL	Defined Benefit (DB)	252	3.0
Public Pension Buffer Fund				
AP Funds	SE	Not explicit	206	None
Sovereign Wealth Fund				
Government Pension Fund Global	NO	Not explicit	1,796	None
GIC	SG	Not explicit	797	None
Hedge Fund				
AQR Capital Management	US	Not explicit	159	None
Bridgewater Associates	US	Not explicit	87	None

For the AP Funds, the annual government review covering all the AP-funds is used: Redovisning av AP-fondernas verksamhet t.o.m. 2025. The GIC, the sovereign wealth fund of Singapore, does not disclose AuM in its annual reports. Instead, the AuM figure in the table of EUR 797 billion is based on latest data from "Global SWF" which is a data platform that tracks over 400 Sovereign Wealth Funds (SWFs) and Public Pension Funds (PPFs). The AuM for AQR Capital Management and Bridgewater Associates end-2025 is based on "Radiant Analytics." When AuM figures are reported in DKK, SEK, NOK or USD, these are converted to EUR by using the exchange rates as of December 31, 2025.

Comparisons with Danish pensions funds

Performance comparisons between market-rate products are frequently undertaken by financial journalists or experts and discussed in the media. ATP undertakes its own version of performance comparisons vis-à-vis the Danish market-rate products to build internal knowl-

edge. These comparisons are reported biannually to ATP's risk committee and annually to ATP's Supervisory Board.

Exhibit 7.80 plots the return in ATP's Investment Portfolio and the returns on market-rate products in various Danish pension companies. The peers include commercial life insurers as well as occupational pension funds. In the period 2015–2025, the average return on ATP's Investment Portfolio has been 11.4 pct per year, which is above market-rate products with high risk. The outperformance is partly due to the reward for taking risk-balanced exposures and that level of risk in ATP's Investment Portfolio is substantially higher than that in the high-risk market-rate products.

To meaningfully compare ATP's performance with peers it is necessary to compare the risk-adjusted returns of different strategies. Exhibit 7.80 therefore also plots the return on ATP's Investment Portfolio where it has been scaled down to reflect the average risk for the pension funds in the high-risk profile (see Section 4.6.2). The risk-adjusted return for ATP since 2015 is 7.2 pct per year. The figure shows that on a risk-adjusted basis, ATP outperformed its peers up to 2022 but underperformed thereafter.

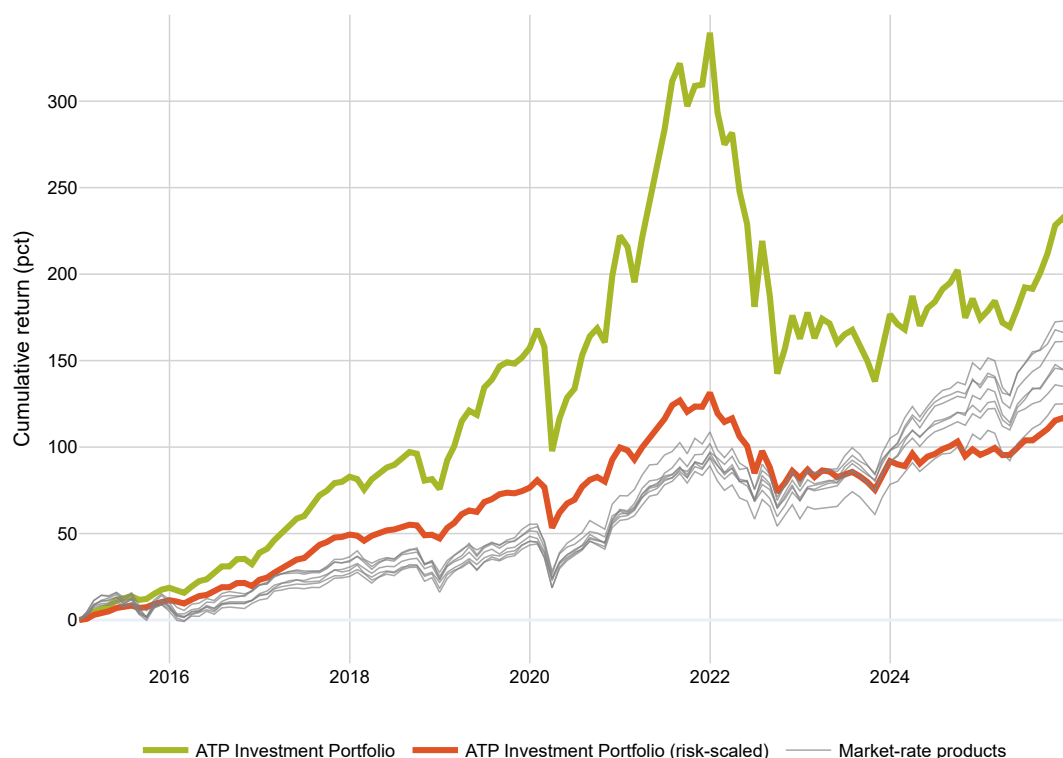


Exhibit 7.80: Cumulative return in ATP's Investment Portfolio and Danish market-rate products in the high-risk category, 2015–2025. ATP's return is scaled to reflect high-risk market-rate products using the "society assumptions" from the Council for Return Expectations. The shaded curves show seven different high-risk market-rate products in Danish pension funds and include both commercial life insurers and occupational pension funds. Source: ATP, [Council for Return Expectations](#), and Nikolaj Holdt Mikkelsen

An alternative comparison is between ATP's Market Return Portfolio and the market-rate products among the Danish peers. The advantage of such a comparison is that a risk adjustment is not needed as the Market Return Portfolio has a risk level that, by design, resembles medium risk in the sector (see Section 4.6.2). The disadvantage of such a comparison is that the Market Return Portfolio was launched in 2022, so the evaluation period is short.

Over 2022–2025, ATP's Market Return Portfolio has underperformed. Exhibit 7.81 shows that the return on ATP's Market Return Portfolio has been slightly negative whereas the peers have had returns in the range between 3.9 pct and 7.2 pct annually. The ATP underperformance is largely due to a higher allocation to fixed income than the peers. This was costly in 2022, and the Market Return Portfolio was also slow to rebound thereafter (see also Section 7.6.4). The performance of the Market Return Portfolio in 2025 has been on par with peers. However, it can also be noted that after the launch of the Market Return Portfolio in 2022 the size was very small. The portfolio is gradually being built up in line with contributions from the members. The size of the Market Return Portfolio was DKK 1.4 billion at end-2023 which grew to DKK 5.1 billion at end-2024 and DKK 7.6 billion at end-2025. The economic impact for the members of the poor returns in the beginning of the lifetime of the Market Return Portfolio has therefore been limited.

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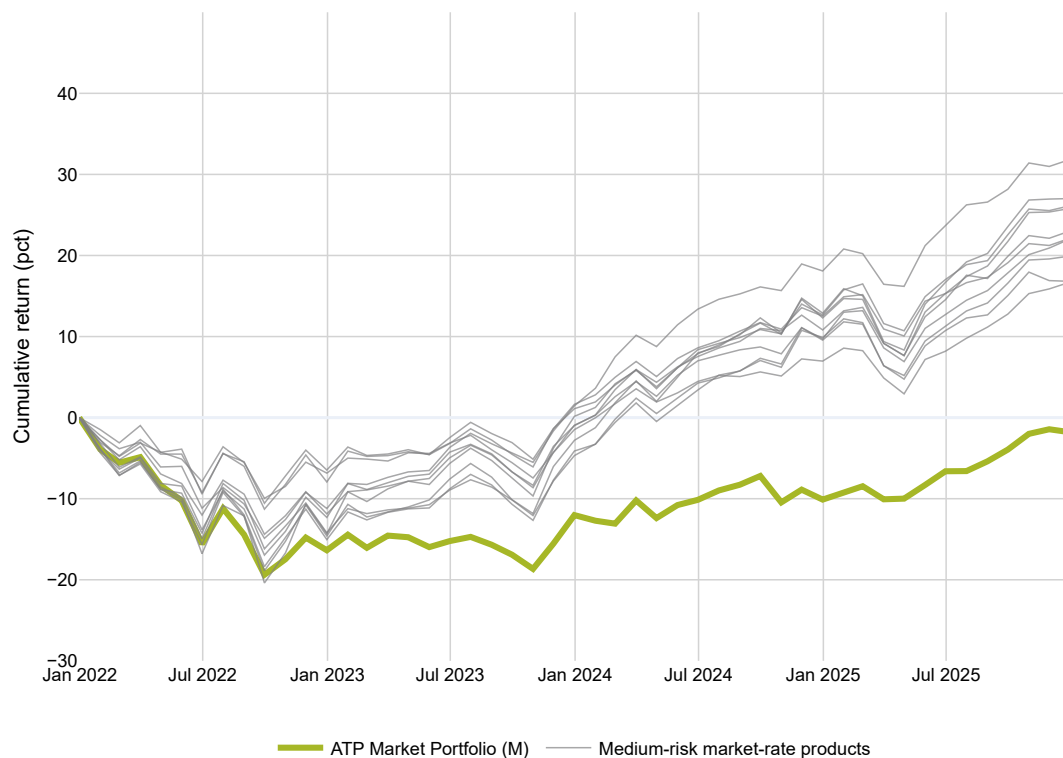


Exhibit 7.81: Cumulative return in ATP's Market Return Portfolio and Danish market-rate products in the medium-risk category and with 20 years to retirement, 2022–2025. The shaded curves show ten different medium risk market-rate products with 20 years to retirement in Danish pension funds. Both commercial life insurers and occupational pension funds are included. Source: ATP and Nikolaj Holdt Mikkelsen.

A final perspective is to compare the wealth accumulation of ATP to the Danish life insurers and occupational pension funds over the very long run. Panel (a) in Exhibit 7.82 shows the actual development of ATP's AuM since 2001 and the counterfactual development in AuM if ATP had realized the returns on the average interest rate products of 19 different Danish life insurers and occupational pension funds. While ATP's wealth grew from DKK 247 billion at the end of 2001 to DKK 694 billion at end of 2025, it could have been around DKK 800 billion and DKK 450 billion if ATP had realized the returns of the Danish peers with the highest and lowest returns, respectively. Panel (b) shows the same calculation, but since 2015.

Variability in performance is large, and ATP ranks around the top third in the considered peer group since 2001, but in the very low end since 2015. This is uplifting, as seen from the ATP pensioner point of view, where the relatively high level of guarantees compared to the peer group has not hampered returns and wealth accumulation in the long run. Conversely, if the comparison would have started in 2015, ATP had delivered amongst the lowest accumulations of wealth.

Differences in returns reflect different liabilities and hedging- and investment strategies. It should be noted that an "average interest rate product" does not necessarily imply that an

interest rate guarantee is present. The level, nature and amount of guarantees varies from company to company and over time, reflecting that some guarantees have been converted to conditional guarantees, even fully removed, lowered via membership choice programs or lowered in connection with bonus allocations.⁹⁵ For some of the peers in question the average interest rate product is still the primary product offered, while for others, the product has gradually become less prioritized over years. The differences presented thus reflect both the investment strategy, but to a large extent also the duration of the liabilities and the chosen hedging strategy. Ultimately, the average interest rate product has been chosen, since it is most representative for a comparison. However, we stress that it does not represent an apple for apple comparison. It is simply not possible to make a 100 pct fair comparison between the peers in the Danish pension industry.

Comparisons of wealth accumulation only make sense for long time-horizons (as stated in Section 7.5.1). The difference between Panel (a) and Panel (b) in Exhibit 7.82⁹⁶ for example reflects that interest-rate changes can cause large changes in total wealth on shorter horizons which ATP experienced in 2022. This change in total wealth is due to hedging activities and would be immunized in the long run. Panel (a), which represents a full interest rate cycle, with decreasing and increasing interest rates, is therefore more suitable for such a performance metric.

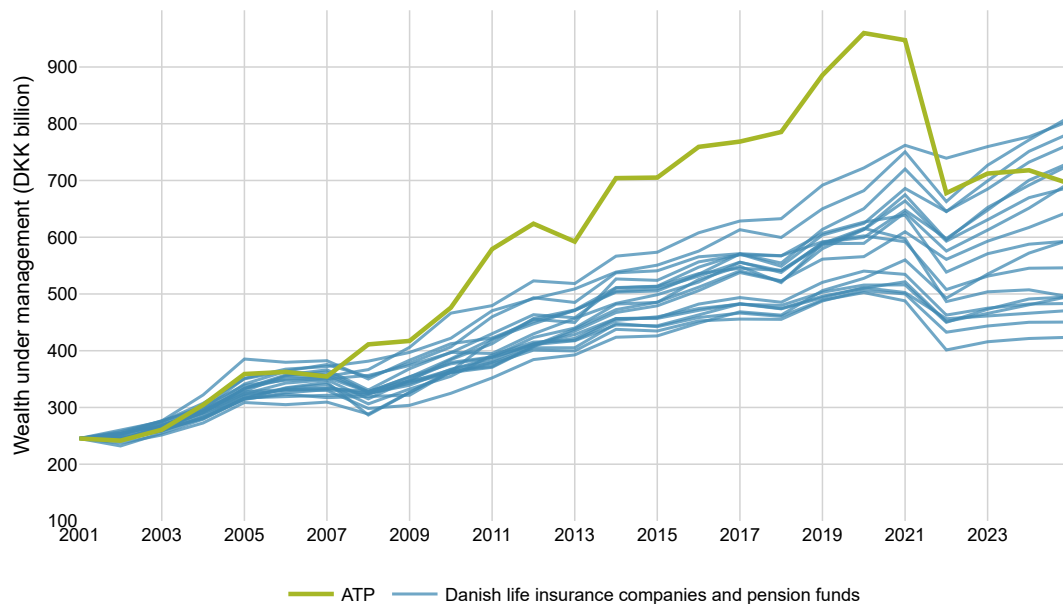
⁹⁵There has been a historical practice amongst life insurers and pension funds where bonus allocated to a specific person would rightfully be allocated to the persons total deposit, but in such a way that the total guaranteed cash flow would be left unchanged or only modestly increased, which effectively had the implication that, per DKK of deposit, the average guaranteed rate for the individual was lowered (becoming more “out of the money” and less constraining on the company’s ability to take on investment risk). The extent to which this could be done depended on the specific contracts and the company’s implementation of the contribution rules.

⁹⁶The peer data reflects a best effort estimate of the returns on average interest rate products amongst the major Danish life insurers (7 companies) and occupational pension funds (12 pension funds). The data stems predominantly from the Danish FSA database of key performance indicators (“Nøgletalsdatabasen”).

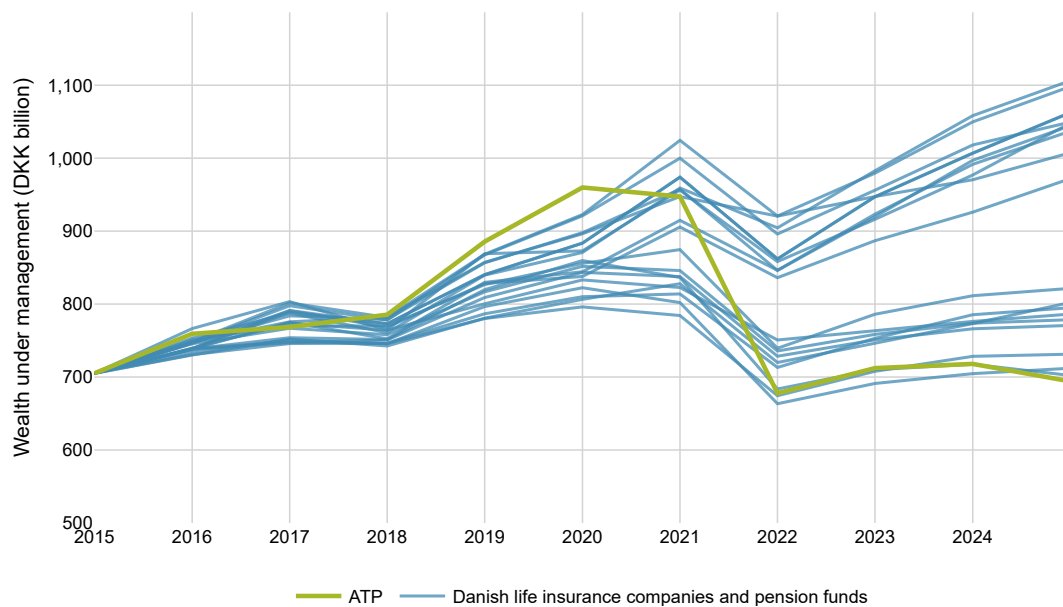
From and including the year 2002 until and including 2015, the key performance indicator is N1, “Return on Investments before tax on pension returns.” This measure reports returns on all assets under management. That is, it includes all collective buffers. From 2016 and onwards, the key performance indicator is “Return on average interest rate products,” reflecting the new reporting requirements, where returns are divided between market rate products and average interest rate products.

Some occupational pension funds only report returns on average interest rate products, while most companies report both. Where data from the FSA database is missing, typically the earliest years as well as the year 2025, data has been completed via annual reports. Likewise, when discrepancies have been found between annual reports and the FSA database, numbers from the annual reports have been used. These represent only minor changes. Some life insurance companies have changed names over time due to mergers or change of ownership. Here, the full returns series have been created by combining old with new names. Data has been cross-checked with www.cvrapi.dk to ensure that the CVR number and hence legal entity is unchanged during the whole period.

Review of ATP's Investment Strategy



(a) 2001–2025



(b) 2015–2025

Exhibit 7.82: Wealth accumulation in ATP since 2001 and 2015. The figure depicts the development in ATP's total wealth (AuM) starting on December 31, 2001, ending on December 31, 2025. The financial year, 2002, is the first year, where all items in the balance sheet were valued at market value and taxation was harmonized across all asset categories. The figure also shows how total wealth would have evolved under the hypothetical situations, where the investments returns would have followed the officially reported returns from ATP's Danish peers. In the hypothetical calculation everything else is assumed equal, including contributions received, benefits paid, bonus strategy, and PAL tax.

Comparisons with international investors

ATP's risk-parity investment approach is less common among asset managers and even less so among other Danish pension funds. To find relevant peers with a similar investment approach, it is therefore necessary to consider international investors. For example, the US asset managers

AQR and Bridgewater have risk parity investment approaches like ATP (Section 4.5.2).

Exhibit 7.83 shows the return on ATP's investments (the total investments and the liquid and illiquid parts of the portfolio) with a set of foreign asset managers that follow a risk-balanced investment approach. The figure also shows the returns on equities, fixed income, and a 60-40 portfolio. All portfolios are scaled to the same risk level—an ex-ante annualized volatility of 10 pct. ATP has generated a higher risk-adjusted return than most of the foreign asset managers. This is the case for both the total ATP portfolio and the liquid portfolio. ATP's return is lower than the equities and 60-40 portfolios. We finally note that it is hard to draw strong conclusions as there is a large statistical uncertainty in the performance metrics.

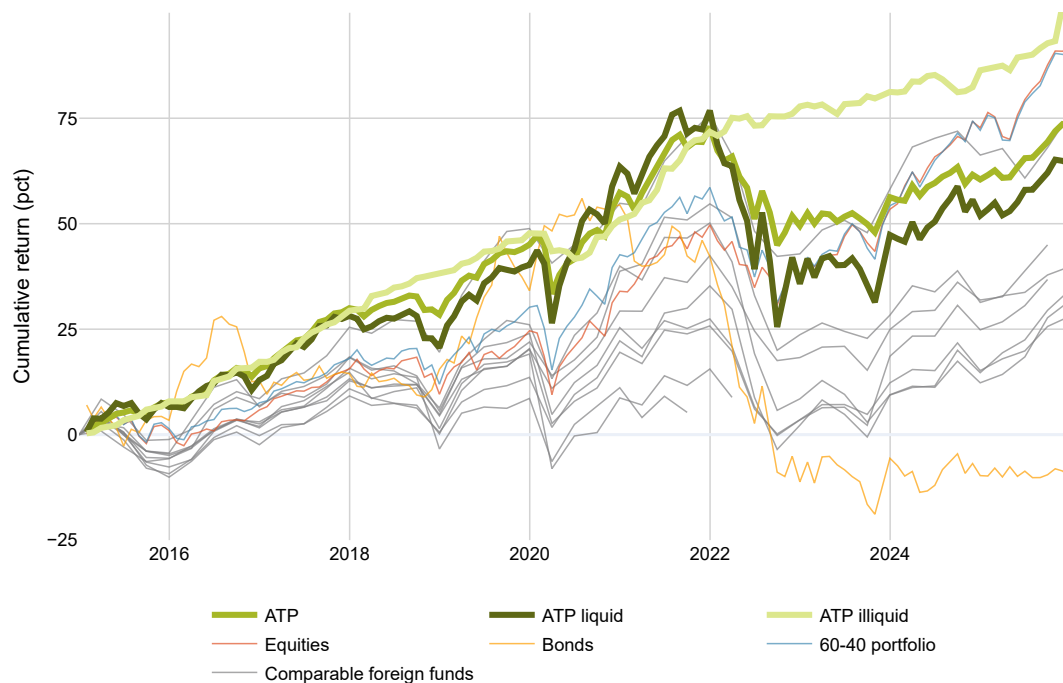


Exhibit 7.83: ATP's Investment Portfolio compared to international investors on a risk-adjusted basis 2015–2025. The returns on the 100 pct equities and 100 pct bonds are MSCI World and Global-Aggregate Total Return Hedged, respectively. The return on the 60-40 portfolio is a constant 60-40 mix of the returns on equities and bonds. The comparable sample consists of nine foreign risk-balanced funds are: AQR, BlackRock, Bridgewater, Columbia, First Quadrant, Invesco, MAN AHL, PanAgora, and Putnam. All returns are scaled to an annualized ex ante volatility of 10 pct, are before tax and after expenses, and are currency hedged to DKK.

7.7.8 Cost comparisons

Key message

ATP is a statutory pension scheme which implies that the members cannot decide to leave. It is crucial for ATP to be cost-effective to ensure responsible management of the funds.

The total cost of operating ATP Lifelong Pension in 2025 was 0.31 pct of AuM. Over the last ten years, ATP's cost ratio has decreased. ATP's cost level is among the lowest in the pension fund industry—both domestically and internationally. Within Scandinavia, ATP's cost level is on par with the Swedish AP Funds but naturally higher than Norway's Government Pension Fund Global (GPF) which has no individual members.

ATP's investment costs are among the lowest both in Danish and global comparisons. A large share of ATP's total costs arises from the illiquid portfolio and performance fees from investing in private equity funds. Notably, the years with large performance fees reflect strong returns in ATP's private equity portfolio.

ATP costs

Cost-efficiency is one of ATP's main strategic objectives. This reflects the statutory nature of ATP's Lifelong Pension and that the purpose of the collective scheme is to provide basic financial security for its 5.8 million members. Keeping expenses low is important for the level of future pensions. It is well known that minor differences in expenses will accumulate over long horizons and can lead to significant differences in pension payments.

Exhibit 7.84 shows the main cost categories for ATP and how they add up to the total cost. The total costs are expressed as a percentage of assets (the "APR" measure in the figure). The definitions of the cost categories are as follows:

- **Administration costs** are costs related to administration of ATP (such as handling contributions from—and payouts to—members, calculation of pensions, customer service, information technology (IT), and similar).
- **Investment costs: ATP** are direct investment costs in ATP (such as personnel-related costs in ATP Pension & Investments and supporting group functions, trading costs, IT-licenses, and similar).
- **Investment costs: Subsidiaries** are direct investment costs in subsidiaries (ATP owns more than 50 pct and are companies administered either by external managers or by ATP, including ATP Real Estate and ATP PEP).

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- **Investment costs: External managers** are indirect investment costs to external managers (ATP owns less than 50 pct) and includes management fees paid to fund managers (such as ATP PEP and Global Direct Investments).
- **Performance fees: External managers'** performance fees.

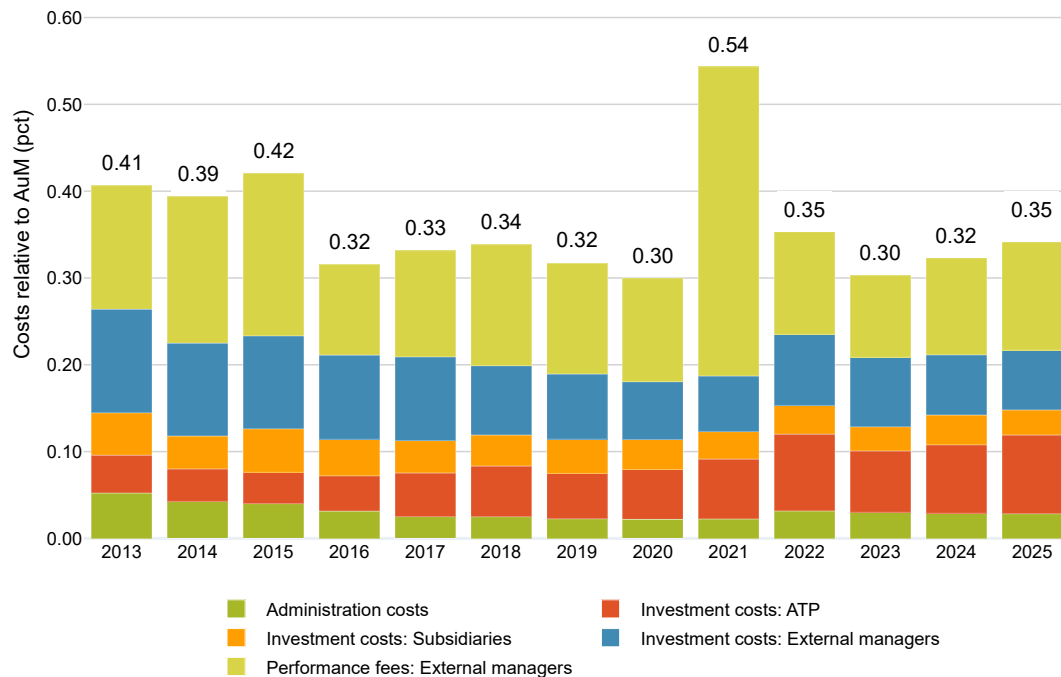


Exhibit 7.84: ATP's total costs as ratio of AuM 2013–2025. The figure shows ATP's actual administration and investments costs split by main cost categories. The figure matches the published cost figures in ATP's annual reports up until 2024, but not 2025 when ATP started reporting according to Forsikring & Pension's expense recommendation. ATP's reported cost in 2025 was 0.31 pct of assets.

Exhibit 7.84 shows that ATP's total costs have fallen from 0.41 pct at the beginning of the period to the range 0.30–0.35 pct in recent years. ATP's total costs were DKK 2,452 million in 2025 (corresponding to 0.35 pct of assets). Note that ATP started reporting costs in the annual report according to Insurance and Pension Denmark's (Forsikring & Pension) expense recommendation with effect from 2025. This implies that total costs reported using standard rates result in DKK 2,153 million in 2025 (corresponding to 0.31 pct of assets). This is lower than using the actual costs. The change in reporting method reflects a preference for increasing transparency when comparing ATP's costs to the rest of the Danish pension sector.

The main variability comes from performance fees for external managers, which are mainly related to the fund investments in PEP and constitute close to half of ATP's total costs. The performance fees are strongly related to the returns, which explains the significant increase in

2021 where PEP realized a return of more than 40 pct. The clear majority of the performance fees are paid to the managers in the underlying funds that PEP invests in, and only a smaller part (less than 5 pct, on average) is paid as carry income to the PEP management team. At end-2025, the total accrued carry income for the entire PEP management team (both former and current partners) across all funds since 2003 was DKK 623 million.⁹⁷

Since inception, PEP has outperformed listed indices after subtracting performance fee and other costs (see Section 7.6.5). However, even in 2021 when performance fees were very high, the total cost of ATP was 0.54 pct, which is a moderate level. The substantial impact of private equity on the cost level is common for all pension funds and institutional investors with a significant share allocated to the asset class.

Exhibit 7.85 shows the developments of costs in nominal terms (instead of as a fraction of AuM). Most cost types are at a lower level today than 10 years ago (even in nominal terms). This implies a significant reduction in real terms, that is, when adjusting for changes in the price level. ATP's total cost level in 2025 was approximately 20 pct lower than in 2013 in real terms.

The administration costs have fallen from more than DKK 300 million in 2013 to DKK 205 million in 2025 (corresponding to DKK 36 per member). This reflects ATP's economies of scale that benefit members in the form of low administration activity expenses. For example, a considerable proportion of communication with ATP's members has been digitized and payment processes in and out are automated (contributing to lower costs).

⁹⁷See ATP (2025).

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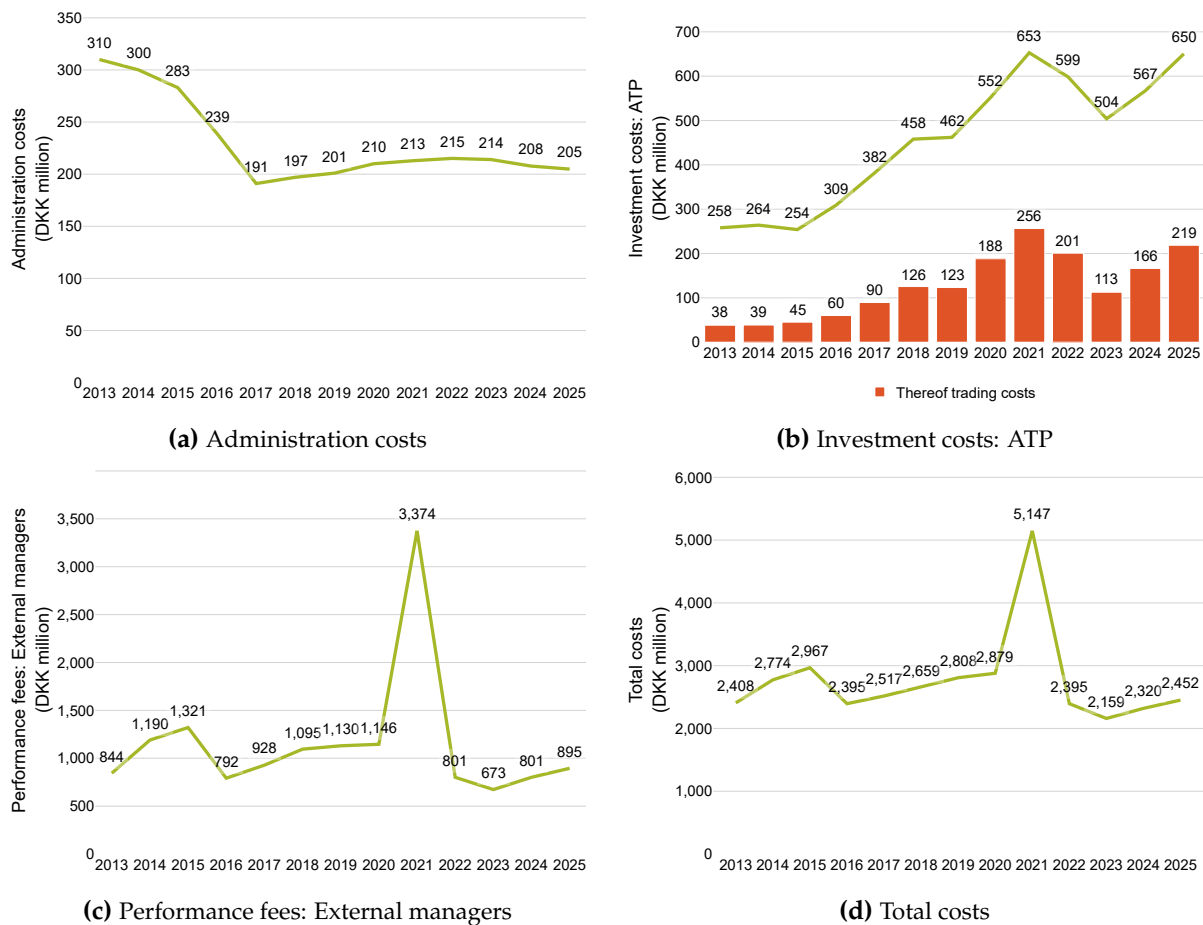


Exhibit 7.85: ATP's costs in nominal DKK, 2013-2025. The figures show ATP's actual administration and investments costs split by four of the six main cost categories.

ATP's investment costs have increased during the evaluation period, as shown in Exhibit 7.85. This is partly due to higher trading costs, which is a consequence of the investment strategy where the risk level in the Investment Portfolio increased around 2017–2019 and the dynamic risk adjustments implied more trading activity. The high market volatility in 2021 reinforced this effect; risk-taking increased due to strong returns and afterwards risk-taking decreased when bonus payments were paid. However, even though trading costs have increased in recent years, they are minor compared to the volume of additional investment risk that was added to the Risk-seeking Portfolios. If the extra exposure had been implemented via external mandates, the corresponding cost would have been extremely high. The increase in investments costs originating from ATP is also partly due to more demanding regulation, compliance, IT systems, and ESG.

From a portfolio level perspective, most costs stem from the illiquid portfolio. Exhibit 7.86 shows that the total cost of running the illiquid portfolio was DKK 1,707 million in 2025 while the cost of the liquid portfolio was DKK 358 million. The difference represents the cost of internal versus external management as the illiquid portfolio has a considerable share of per-

formance and management fees in fund investments.

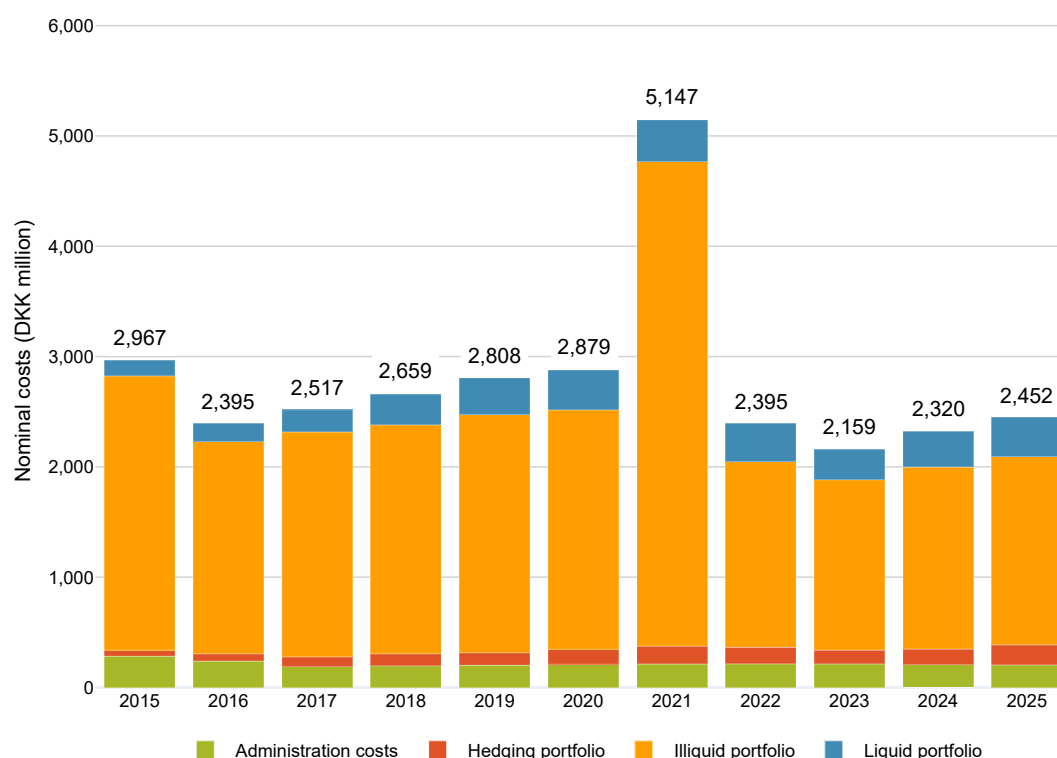


Exhibit 7.86: ATP's costs in nominal DKK with portfolio split. The figure shows ATP's administration cost and investment costs with the latter being split on the Interest Rate Hedge Portfolio, the illiquid portfolio, and the liquid portfolio.

Number of employees at ATP

The total number of employees at ATP, including its subsidiaries, has increased substantially during the last ten years. The increase is mostly driven by stronger regulatory demands and insourcing. ATP's total cost level (DKK 2,452 million in 2025) includes all costs associated with operating ATP Lifelong Pension—no matter whether functions sit internally within ATP's Pensions & Investments Department or are outsourced to other organizational units either within the rest of ATP or externally. Exhibit 7.87 shows that the number of full-time equivalents (FTEs) has increased from 212 in 2016 to 329 in 2025. The number of employees affects the cost level but is not the main driver. However, the development in FTEs is relevant to the analysis as it can signal the operational efficiency of ATP and reveals underlying strategic decisions (such as choices between insourcing and outsourcing).

The largest function is Investments with slightly above 100 FTEs in 2025 and with the majority residing internally in the Pensions & Investments business. The number of Investment people in ATP Real Estate and ATP Private Equity Partners in 2025 were 32 and 8, respectively. Overall, the number of FTEs in the Investment function has increased during the last decade, which is

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a result of increased in-house management of liquid investments and more demanding ESG processes.

The function displaying the largest growth in FTEs during the last decade is Business Support—growing from 33 FTE in 2016 to 82 in 2025. The rise comes from both internally within ATP and from ATP Real Estate and is related to functions such as business development, data, software, and analytics. The significant jump in FTEs from 2024 to 2025 is a one-off effect due to an organizational change in ATP's Administration Business which moved an IT Applications team into the P&I organization.

Property Management & Development is a function that resides in ATP Real Estate. There has been a significant increase in the number of employees related to Property Management & Development at ATP Real Estate during the last ten years, as the number has doubled from 29 to 58 (see Exhibit 7.87). The growth reflects a strategic shift where ATP Real Estate has grown from primarily being a real estate manager to being a property manager and developer (with many operational functions insourced and commercial development to manage). The number of FTEs in ATP Real Estate has also grown in Finance and Controlling and Business Support, while the Investment Department has been stable.

Exhibit 7.87: Full-time equivalents (FTEs) at ATP, 2016–2025. The table shows FTEs by organizational function. Investment FTEs are further split into internal ATP, ATP Real Estate, and ATP Private Equity Partners.

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Investments (CIO)	84	83	93	93	99	98	100	98	102	103
of which are internal ATP	46	49	59	62	64	65	66	64	61	62
of which are ATP Real Estate	30	26	29	25	30	26	27	25	32	32
of which are ATP Private Equity Partners	8	8	5	6	6	7	6	8	8	8
Risk & Pensions (CRO)	27	30	30	36	39	37	34	35	37	39
Business Support (COO)	33	26	31	43	47	54	56	57	65	82
Finance & Controlling (CFO)	25	26	33	24	24	24	28	24	31	35
Corporate Affairs and other	13	9	6	9	10	13	14	16	12	12
Property Management & Development (ATP Real Estate)	29	34	37	46	53	59	52	60	55	58
Total FTE	212	208	231	251	274	284	284	290	302	329

ATP PEP has been a small and stable organization during the last decade (with close to 15

FTEs).

ATP in comparison with international peers

A CEM Benchmarking analysis shows that ATP is among the most cost-effective funds globally on both administration and investment costs. The CEM Benchmarking analysis⁹⁸ includes data until 2024 and compares administration and investment costs of international pension funds like ATP in terms of size and composition of the balance sheet. More precisely, the characteristics of the funds are:

- Operations on a large scale (from USD 75 billion to USD 500 billion and above).
- Funds typically have from hundreds of thousands of members to millions of members.
- Mix of mature funds and funds which still enjoy strong new inflows.
- Varying liability structures (DB, DC, and hybrid DC).

The CEM Benchmarking analysis is based on a detailed questionnaire, with clear methods and instructions.

ATP has had significantly lower administrative costs than peers. This is primarily due to customer and IT support, where ATP operates much more cost-effectively than other funds—the uniformity of the ATP pension product reduces the need for individual and targeted customer support, advisory, etc. In addition, ATP has the largest number of members among the peer group which gives ATP a scale advantage. Exhibit 7.88 shows that the administration cost per member was DKK 36 in 2025 (and DKK 37 in 2024)—not even 1/10 of the average for comparable funds, which have administration costs close to DKK 700 per member. (The conclusions are robust when extending the data period. ATP's administration costs have consistently been much lower than its peers and even exhibit a falling trend during the last 5–7 years, while peers have seen a rise in administration costs.)

⁹⁸CEM Benchmarking (“Pension Administration Benchmarking 2024” and “Investment Benchmarking Analysis 2024”).

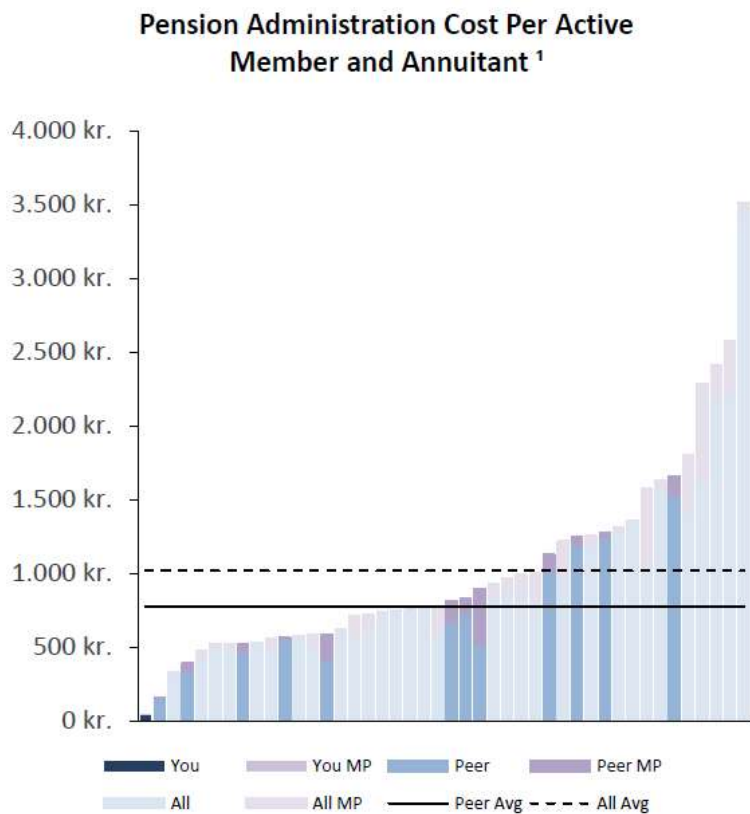


Exhibit 7.88: ATP's administration costs compared to international peers. The figure shows the pension administration cost per member for ATP and for the other funds included in the analysis. ATP's peer group consists of 13 funds (including ATP) and is shown separately. "MP" means "major project costs" and refers to one-off costs related to administration. Source: Reproduced from CEM Pension Administration Benchmarking Subscription, 2024.

ATP has significantly lower investment costs than peers. The CEM benchmarking analysis includes 240 global pension funds and ATP is compared to a peer group of 19 pension funds across Europe, North America, and Australia. Exhibit 7.89 shows that ATP's investment costs in 2024 were just below 0.30 pct of assets, which was lowest among all peers (the peer median was 0.66 pct).

Two contributing factors for ATP's low investment costs are fund size and the composition of assets. Large funds typically have advantages of scale and funds with a large share of private assets are more expensive than funds more oriented towards public markets. ATP has a large share of fixed income due to the guaranteed pensions and fixed income is a low-cost asset class. The benchmark analysis shows that even after adjusting for fund size and asset mix, ATP still had costs that were 0.05 pct lower than the "benchmark" in 2024. This reflects that ATP has a lower cost in the implementation of the investment strategy due to more internal management at lower costs than its peers.

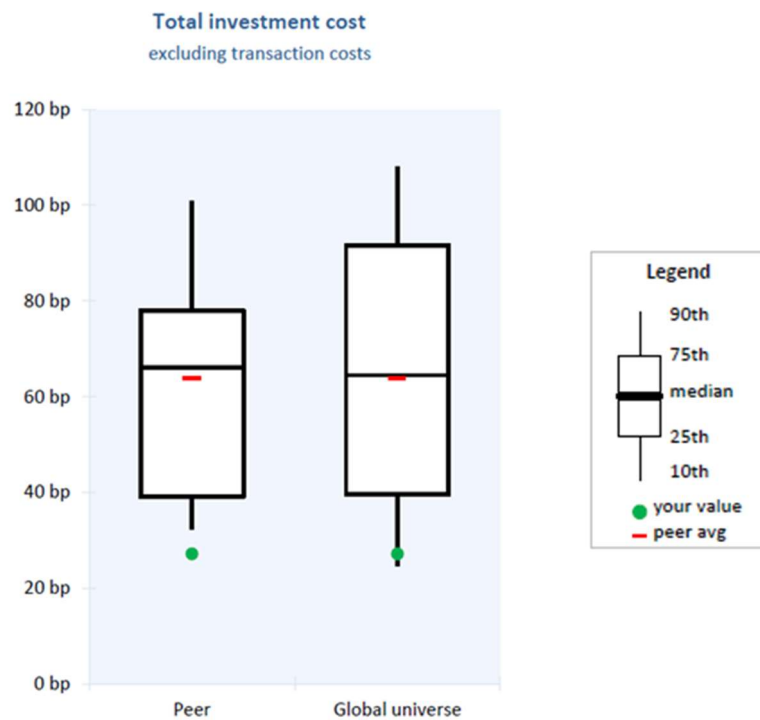


Exhibit 7.89: ATP's investment costs compared to international peers. The chart shows the distribution of ATP's investment costs compared to a global universe of 240 pension funds and a peer group of 19 pension funds (including ATP). Figures are in basis points; 100 basis points equal one percentage point. Source: Reproduced from CEM Investment Benchmarking Subscription, 2024.

ATP in comparison with AP Funds and GPFG

Based on being large, public, and Scandinavian, Section 7.7.7 lists the Swedish AP Funds and the Norwegian GPFG as peers for ATP. Neither the AP Funds nor the GPFG is part of ATP's peer group in the CEM benchmarks for administration or investment costs. This is because none of them have members, for which reason they do not administer individual pension accounts.

AP Funds and the GPFG are highlighted as highly cost-effective and with officially reported cost levels at a much lower level than ATP. While it is beyond the scope of this report to assess whether these funds are cost-effective or not, it is relevant to compare their cost levels with ATP's. It turns out that the headline cost figures in the AP Funds and the GPFG include fewer cost categories than ATP includes when reporting total costs. Caution should therefore be exercised when making comparisons.

The Swedish AP Funds manage the buffer capital in the Swedish national pension system. A press release related to the annual result in 2024 for the buffer funds (AP1, AP2, AP3, AP4, and AP6) highlighted that "In 2024, total management costs amounted to 7 bp of assets under management. The AP Funds are cost-effective in international benchmarking."⁹⁹ The reported cost

⁹⁹Press releases—Andra AP-fonden. The cost figure of 0.07 pct is reported in the so-called Orange Report 2024—

of 0.07 pct is much lower than ATP's total costs of 0.32 pct in 2024. However, the costs for the AP funds only include investment costs and management fees for listed assets, and not administration costs, management fees for unlisted investments, or performance fees. Exhibit 7.90 shows that ATP's corresponding costs were 0.09 pct in 2024.

Exhibit 7.90: Cost levels in AP Funds and ATP, 2024. The table shows a comparison of cost levels between AP1-AP4 and AP6 based on the Orange Report (left column), AP4 based on their own annual report (middle column), and ATP (right column). The methodology is based on the included cost categories in the officially reported total management costs in the Orange Report 2024. Source: Orange Report 2024—Pensionssystemets årsredovisning, and AP4 Annual Report 2024.

SEK or DKK million, 2024	AP Funds (SEK)		AP4 (SEK)		ATP (DKK)	
	Amount	pct	Amount	pct	Amount	pct
Investment costs	1,254	0.064	291	0.053	646	0.090
Management fee, listed assets	239	0.012	104	0.019	7	0.001
Total costs	1,493	0.077	395	0.072	653	0.091
AuM, average	1,950,000		548,240		717,972	

ATP's official reporting of cost is based on the expense recommendation by "Insurance and Pension Denmark" (Forsikring & Pension). This recommendation specifies what to include in the calculation of total costs relative to assets for Danish pension funds.¹⁰⁰ Hence, to be able to compare the cost levels of the AP Funds with ATP, we add administration costs, trading costs, management fees for unlisted assets, and performance fees for listed assets from the Orange Report and the individual annual reports for the AP buffer funds.¹⁰¹ By adding all the publicly available costs the AP Funds total costs are 0.31 pct, which is similar to ATP's total costs. However, for the AP Funds, this cost level does not include performance fees for unlisted assets (not reported). Neither are costs related to operation and management of unlisted real estate investments. Performance fees for unlisted assets were more than one third of ATP's costs in 2024.

In comparison of total costs, it is noteworthy that the AP Funds have a larger share of private market investments than ATP. Due to the guaranteed pensions and the Interest Rate Hedge Portfolio, ATP has a large share of AuM in fixed income, which is a low-cost asset class com-

Pensionssystemets årsredovisning, which describes the financial position of the national income-based pension system; see Orange Report 2024—Pensionssystemets årsredovisning.

¹⁰⁰This section compares 2024 costs levels, and ATP did not fully follow F&P's expense recommendation until 2025. However, the difference only applies to calculation of certain cost types and not the scope of which costs to include. Hence, this detail is not important for the conclusions in this section.

¹⁰¹Appendix F contains more details on which cost types are published by the AP Funds and GPFG.

pared with private markets. Note that the analysis for the AP Funds is based on 2024 reporting and hence there is no effect from the recent consolidation of the AP Funds. (By the end of 2025, AP1 dissolved and its assets were transferred to AP3 and AP4. In addition, AP6 merged into AP2.)

The cost level in the Norwegian GPFG is exceptionally low, even after correcting for costs not included in the officially reported headline figures. GPFG reported management costs at 0.04 pct of assets in 2024.¹⁰² This figure excludes, for example, transaction costs (trading costs). By adding transaction costs and other minor cost types (all publicly available), the total cost of the GPFG ends at 0.07 pct in 2024. Compare this number with ATP's total cost level at 0.32 pct.

GPFG's low costs reflect the fund's key characteristics. GPFG is the largest investor in the world and has considerable scale effects. It is also a sovereign wealth fund with no members and no costs associated with individual member administration. Additionally, it mostly invests in public markets at lower costs than in private markets. At the end of 2025, approximately 98 pct of GPFG's assets were listed equities or bonds while only 2 pct were private market investments. This feature is a deliberate investment strategy choice and hence not given "per construction."

ATP in comparison with Danish Pension Funds

ATP is cost-efficient in comparison to the Danish pension sector. Exhibit 7.91 below shows ATP's costs from 2017 to 2024 compared with the costs among the Danish funds. The Danish pension funds are weighted by the size of their provisions and the costs of both guaranteed products and market-rate products are included.

From 2017 to 24, ATP's total cost level has on average been less than half of total costs among the Danish funds. ATP's average total cost across the period was 0.35 pct while the average cost in the sector was 0.93 pct. The cost levels are generally quite stable from year to year both in ATP and across the Danish funds. However, ATP had a significant spike in costs in 2021 as discussed above.

¹⁰²Web report Annual report 2024—Norges Bank Investment Management.

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Exhibit 7.91: Costs across Danish pension funds, 2017–2024. The figure shows the total costs in Danish pension funds split on investment costs, administration costs, and other costs. “Other costs” arise in average-rate products as the payment for the risk associated with delivering the guarantee. The pension funds are weighted by the size of their provisions. The sector does not include ATP. Source: ATP calculations based on annual reports for the respective pension funds and the expense recommendation from Insurance and Pension Denmark (Forsikring & Pension).

Both ATP’s administration and investment costs are significantly lower than those of the Danish peers. The average administration cost in the sector was 0.21 pct from 2017 to 2024 while ATP’s corresponding average cost was 0.03 pct. Within Danish pension funds, the administration costs are higher for the commercial funds than for the non-commercial. This reflects the costs associated with customer services and, in this respect, ATP is more like a non-commercial fund. Also, when compared to the non-commercial funds, ATP still has low administration costs.

Chapter 8

External views on ATP

Key message

The external views we have received cover a wide range of issues, but they cluster around a recognizable set of themes that align closely with our own focus: the role of ATP within the broader Danish pension system, the level and form of investment risk, the use of leverage and illiquid assets, the inflation indexation objective, the complexity of the model and its implications for governance and communication, and the appropriate level of contributions.

This section summarizes the discussions and interviews we conducted with external observers in connection with our evaluation of ATP's investment strategy and its implementation. It also summarizes and discusses published articles on ATP's performance.

8.1 Initial reflections

Some observers have criticized ATP both for its institutional design and in the way it implements its investment strategy. Institutional design falls outside our mandate, which is to assess ATP's investment strategy and its implementation. To provide the context, we summarize all views expressed, but we respond only to issues that are relevant, or borderline relevant, to our mandate.

ATP benefits when external observers take the time to consider its design and performance. Such engagement contributes to a more informed debate, from which we have also benefited, and we are grateful to those who have contributed. Discussions of this kind naturally evolve as positions are stated, challenged, and refined, and that evolution is reflected in the views summarized below.

ATP is a complicated construction and it is not trivial to model it. We recognize the contribution made by efforts to model ATP (see Section 8.2), while noting that approximations and simplifying assumptions are unavoidable features of any such exercise. Modeling often yields interesting insights even without capturing the full complexity of real life, but one should be careful not to extend the interpretation of model results beyond what the assumptions allow.

8.2 Criticism by Hebsgaard, Ramlau-Hansen, and Rangvid

We discuss a series of papers by [Ramlau-Hansen \(2019\)](#), [Ramlau-Hansen and Rangvid \(2023\)](#), and [Hebsgaard, Ramlau-Hansen, and Rangvid \(2025a\)](#) that criticize the design and performance of ATP (hereafter collectively referred to as HRR). The exchange includes responses from ATP by [Johansen and Gosvig \(2019\)](#) and [Lester and Svenstrup \(2025\)](#), and a rejoinder by [Hebsgaard, Ramlau-Hansen, and Rangvid \(2025b\)](#) to [Johansen and Gosvig \(2019\)](#) and [Japhetson et al. \(2025a\)](#) and [Japhetson et al. \(2025b\)](#). We summarize the most important issues and present our views.

8.2.1 Criticism by HRR

[Ramlau-Hansen \(2019\)](#), the opening paper in this debate, asks whether ATP's Bonus Potential is invested with excessive risk. He assumes that ATP operates with an Expected Shortfall within three months of DKK 45 billion (based on ATP's own numbers) on a Bonus Potential of DKK 120 billion, and notes that ATP has invested DKK 136 billion in illiquid alternatives that would be difficult to reduce in the short run. The concern is that in a downturn ATP could end up with a concentrated portfolio of illiquid assets that is difficult to rebalance, increasing the risk to its guarantees. Ramlau-Hansen attributes this risk-taking to the high return requirements (11 pct) that ATP has imposed on itself, which include covering mortality risk, the roll-in of liabilities arising from the kink in the discount curve, and the indexation of tariffs (see Chapters 5 and 6). He estimates that ATP may need to generate a return of up to 30 pct before tax per year on the Bonus Potential. Ramlau-Hansen considers ATP to be a sensible construction that should remain primarily a guaranteed product. He discusses the application of Solvency II and shows that ATP's risk taking is very high compared with a Solvency II requirement but does not argue that ATP should be subject to Solvency II requirements.

[Ramlau-Hansen and Rangvid \(2023\)](#) take the criticism several steps further. [Ramlau-Hansen and Rangvid \(2023\)](#) argue that, historically, the investment return generated by ATP has been more or less on par with that of a global equity portfolio, but risk has been much higher, and for example the risk-adjusted return generated by ATP has been low. They argue that ATP should explicitly acknowledge that it cannot ensure pensions are adjusted fully in line with inflation.

They recommend abolishing leverage and investing instead in a diversified portfolio of “real assets.” They also propose that ATP adopt a life-cycle model in which a high share of members’ contributions is invested in risky assets until 15 years before retirement, after which holdings are gradually converted into bonds backing guaranteed annuities. These annuities would be distributed according to a profile designed to ensure a constant expected real pension. Were ATP to take these steps, they recommend that contributions be almost tripled.

Ramlau-Hansen and Rangvid (2025) and Hebsgaard, Ramlau-Hansen, and Rangvid (2025a) make ten recommendations, including a proposal for a fundamentally new product model.

Their first and central recommendation is to change the ATP product to a life-cycle product, in line with their 2023 proposal and the broader literature on life-cycle models. In their model, pension payouts are guaranteed from pension age, similarly to the current ATP-product. They further argue that a shift toward higher equity exposure for younger people is warranted by the low share of equities in the asset holdings of pensioners whose only pension income is the public pension and ATP. Based on simulations, they recommend increasing the contribution level to ATP by almost a factor of three if the product is changed in the direction they propose. If no such changes are made, they recommend that ATP savings be allowed to be transferred to other pension funds.

If the above recommendations are not followed and the current ATP product is kept as is, they make the following recommendations:

- ATP should be subject to regular, independent performance assessment, and there should be an investment benchmark for each portfolio as well as a benchmark for the total product.
- The share of Danish equities should be reduced, and ATP’s equity investments should be aligned with a broad market index.
- The share of illiquid investments should be reduced.
- Investment costs should be lowered.
- ATP should recognize that pensions cannot be fully inflation indexed, and the special bonus allocation to pensioners should be discontinued.
- The bonus share should be increased to 25 pct before disbursements begin.
- The governance model should be changed so that labor market representatives no longer sit on the Supervisory Board, as they face conflicts of interest from their own pension funds.

- ATP should be transferred from the Ministry of Employment to the Ministry of Industry, Business, and Financial Affairs (now the Ministry of Taxation and Economic Growth), which is responsible for the other pension funds, and ATP should be subject to the same legislation as other pension funds, including Solvency II.

Hebsgaard, Ramlau-Hansen, and Rangvid (2025b) are also critical of the profile of payments in the retirement phase and of the introduction of the Supplementary Hedge Portfolio. Hebsgaard, Ramlau-Hansen, and Rangvid (2025b) argue that even when modelling the ATP-product as Lester and Svenstrup (2025), the model proposed by HRR still yields higher expected pensions than the current ATP product. Furthermore, Hebsgaard, Ramlau-Hansen, and Rangvid (2025b) model the payout phase, and they argue that the profile of the payments in the pension phase should not increase substantially as their simulations suggest. This would skew payments towards those living longest. They also believe that the Supplementary Hedge Portfolio is questionable as it is too risky because it increases risk when approaching insolvency and creates too high a likelihood of the funding ratio becoming less than one.

8.2.2 Response by ATP

Johansen and Gosvig (2019) respond to Ramlau-Hansen (2019) on behalf of ATP, and they argue that ATP needs to balance returns and guarantees. Specifically, the challenge for ATP is to strike a balance between generating sufficient returns to lift the already guaranteed pensions in line with inflation over the long run and protecting the guaranteed pensions in the short run. The risk level in the Investment Portfolio is therefore calibrated to support the real value of the guaranteed pensions. While this calibration may produce significant volatility in Investment Portfolio outcomes, the associated risks remain within the risk appetite set by ATP's Supervisory Board. They disagree with Ramlau-Hansen's conclusions on investment risk and leverage, arguing that the assumed risk is reasonable relative to the size of the Bonus Potential, that risk is within Supervisory Board-approved limits, and that the applied leverage does not jeopardize ATP's ability to meet liquidity needs. Investments can and will be adjusted within a quarter, making it even less likely that an Expected Shortfall event would be realized. They stress that although investment returns are challenged by low real interest rates, ATP's ability to protect guaranteed pensions remains intact even in such scenarios, while acknowledging that delivering inflation-linked increases in the guaranteed pensions remains a challenge. They estimate the probability that ATP will need to reduce exposure to illiquid investments within a quarter at substantially less than 1 pct and note that ATP's illiquid investments are balanced in terms of risk exposure, which limits the risks that could arise if the Investment Portfolio became too concentrated (for example, in illiquid assets). They agree that the guarantee of nominal pensions represents a significant constraint on ATP's investment strategy.

Johansen and Svenstrup (2023) provide ATP's response to Ramlau-Hansen and Rangvid (2023) and disagree with both the recommendation to change the investment strategy and the recommendation to change the pension product itself. On the latter, they argue that the proposal does not take account of ATP's role, as set out in the ATP Act, to deliver guaranteed and life-long pensions based on a collective pension model. They argue that there is both theoretical and empirical support for the view that leverage applied in a risk parity approach yields a better reward-to-risk trade-off than a 60-40 or all-equity portfolio, while acknowledging that risk parity portfolios can underperform a 60-40 portfolio for extended periods. They contest the claim that 2022 was not unusual, noting that it was the worst year for ATP's strategy in 85 years, combining live and simulated backtested performance. They also recognize that ATP has not been able to deliver full indexation but emphasize two points. First, the legislation requires ATP to *strive* for full indexation rather than *guarantee* it. Second, the tariffs already include compensation for both a real return and expected inflation, so inflation is already incorporated into the guarantee. Accordingly, the Supervisory Board sets a risk level aimed at creating optimal conditions for pension growth while keeping the risk of insolvency at acceptably low levels. Finally, they note that some of the changes implemented by ATP in 2021—particularly increased risk-taking when an individual is young—align with suggestions from Ramlau-Hansen and Rangvid. Other recommendations, however, would represent a fundamental break with ATP's collective model and would be very costly, including dropping the use of the Bonus Potential to ensure lifelong pensions and migrating to a model with individualized deposits and no risk-sharing.

Lester and Svenstrup (2025) provide ATP's initial response to Hebsgaard, Ramlau-Hansen, and Rangvid (2025a) and note that ATP is governed by the ATP Act and that legislators have preferred gradual and incremental changes. Changes should be made with due consideration of accrued pension rights and ATP's role as a Pillar 1 supplement. The ATP product is collective rather than individual, with both market and mortality risks shared on a collective basis, and Pillar 2 products can be designed to take ATP's investment policy into account.

Japhetson et al. (2025a) provide a more elaborate response, noting that the current ATP product reflects ATP's historical development, including commitments to 5.6 million members. They argue that a simpler product could have been designed if ATP had started from scratch, regard continued low costs as a legitimate objective and identify benefits in ATP offering a product that differs from the more life-cycle-oriented products elsewhere in the Danish system.

Japhetson et al. (2025b) respond to Hebsgaard, Ramlau-Hansen, and Rangvid (2025b) and query the profile during the retirement phase. They argue that HRR does not model the retirement phase. They note that the inclusion of the Supplementary Hedge Portfolio leads to

similar levels of savings at the retirement age in their own and HRR's calculations.

8.2.3 Assessment

We broadly agree on some of the questions raised by HRR, partially agree on others, and disagree on other issues. There is broad agreement, including ATP, on the difficulty of generating returns that are sufficient to ensure indexation of the guaranteed pension benefits. There is also some agreement, including ATP, that the risk-taking in the Investment Portfolio is substantial. [Ramlau-Hansen and Rangvid \(2023\)](#) disagree that a leveraged risk-parity strategy is superior to an unlevered portfolio of real assets, such as listed equities, private equity and similar. We believe that, in the long run, a levered risk parity portfolio is expected to deliver the highest return for a given level of risk by diversifying across more asset classes and risk premiums than an unlevered portfolio of real assets. ATP should apply leverage to harvest the benefits of the risk parity portfolio. Exhibit 8.1 summarizes the main recommendations of HRR, ATP's response, and our assessments. The focus is on the most recent positions.

Exhibit 8.1: Recommendations by HRR in the case that the ATP product is not changed.

Hebsgaard, Ramlau-Hansen, and Rangvid (HRR)	Lester and Svenstrup (ATP)	Evaluation Group
Regular independent performance assessments and introduction of an investment benchmark.	Partly agree.	Agree, including the need for investment benchmarks at the portfolio level and possibly at sub-portfolio levels.
Lower the share of Danish listed equities and, more generally, follow a global index.	Disagree. The share of Danish listed equities has been selected to balance expected returns and portfolio risk, with due consideration of the comparative advantages ATP holds in the asset class. ATP generally does not follow cap-weighted indices, primarily to increase diversification.	Agree on that the share of Danish equities is high, but we find that deviating from the index and having a home bias can historically be justified by performance. There is a need to assess the appropriate level going forward.
Lower the share of illiquid investments.	The exposure to illiquid assets has been lowered substantially over the last few years.	Agree that the share of illiquid assets was, and likely still is, too high. There is a need to assess the appropriate level.

Review of ATP's Investment Strategy

Exhibit 8.1 (continued)

Hebsgaard, Ramlau-Hansen, and Rangvid (HRR)	Lester and Svenstrup (ATP)	Evaluation Group
Lower investment costs.	Disagree. The calculation of costs is biased.	Disagree. External assessments show that ATP is a low-cost fund on an overall-cost basis.
Acknowledge that indexation is not possible and drop the special bonus allocation to pensioners.	Indexation of the guaranteed benefits is a significant challenge. Agree that public transparency on this point is appropriate, and ATP publishes assessments of its ability to deliver indexation. Ambition must not jeopardize the process by which the Board sets a risk level aimed at creating optimal conditions for pension growth. The special bonus allocation to pensioners is an important element.	Agree that indexation is a very challenging target. The bonus allocation is outside our mandate.
Lift the Bonus Potential to 25 pct before disbursements.	Agree that a higher Bonus Potential will increase the likelihood of inflation indexation and that it offers other advantages, but there is a fairness-related trade-off, as some beneficiaries will miss out on bonus allocation for some years.	Agree that a higher Bonus Potential will increase the likelihood of meeting inflation indexation, but with a trade-off for those who miss out on bonus allocation for some years.
Change the Board to exclude labor market parties.	Political question.	Outside our mandate.
Shift the responsibility for ATP to the Ministry of Industry, Business, and Financial Affairs and make ATP subject to the same legislation and supervision as other pension funds.	Political question. It is noted that major parts of the regulation of Danish pension funds are already implemented in the ATP Act, and that supervision is already delegated to the FSA.	Outside our mandate.

We take the present legislation as our starting point, which is also the view reflected by ATP. HRR argue that the current ATP-product is not suitable as a mandatory Pillar-1 product and thus should be changed. HRR acknowledge that their proposals fall outside this legislation.

We, ATP, and HRR agree that inflation indexation is a challenging ambition. There is also agreement between the two parties that the level of risk required in the Investment Portfolio to meet this objective produces substantial volatility in Investment Portfolio returns.

ATP believes that the level of illiquid assets a few years ago was on the high side of the acceptable range and has reduced the level accordingly, which also aligns with HRR's recommendation. The relative weight of liquid and illiquid assets will generally move with liquid asset performance. We agree that the level of illiquid assets needs to be reassessed (see Section [10.4.5](#)).

ATP should limit its risk-taking to within what is prudent and take risk efficiently. Within the established product framework, the Supervisory Board expresses the desired level of investment risk. One prudent reference point is Solvency II, under which funds are required to manage and design investment portfolios with less than a 0.5 pct probability of total loss over a one-year horizon. As a Pillar 1 pension fund with systemic importance, ATP should take risks well within what is considered prudent. This raises the question of how risk can be taken most efficiently. There is support for the view that leveraging the efficient portfolio—where the capital allocation line touches the mean-variance frontier—provides the most favorable long-run trade-off between expected return and risk. There is also a trade-off between adding diversification benefits from illiquid assets and the risk of holding a portfolio that cannot be readily rebalanced when markets fall.

ATP's separation of portfolios is sensible but leads to concentration of risk in the Investment Portfolio. ATP remains bound by current legislation to allocate part of the pension contributions to a nominally guaranteed pension. ATP therefore uses a large share of its assets to hedge its guaranteed obligations, while the remaining assets are invested across strategies that involve risk. This separation of portfolios is consistent with theory and with best practice. One implication, however, is that risk-taking is more concentrated within the Investment Portfolio.

ATP has, in recent years, increased the risk in its product, particularly since 2021, with the segregation of contributions into guaranteed, market-linked, and risk-absorbing components. The market-linked element includes a gradual de-risking feature akin to a life-cycle product, in line with HRR's subsequent proposal, and a substantial share of contributions is now invested in risky strategies. ATP's investment strategy has thus moved partly in the direction advocated by HRR, which partially explains why the expected value of ATP's assets can be somewhat similar under the two products. At the same time, the changes implemented in 2021 have considerably increased the complexity of the business model.

We stress that while 60-40 equity-bond and all-equity portfolios have their uses in bench-

marking, they are not appropriate references for ATP's overall performance. We also agree with ATP that 2022 was a highly unusual year for ATP's investment strategy. ATP's theoretical and empirical work indicates that, in the long run, a leveraged risk-parity strategy is superior to a 100 pct equity strategy or a 60-40 strategy. We share this view. It is consistent with the general principle in finance that diversification improves risk-return trade-offs. However, there may be long periods during which other strategies perform better. This raises the question of whether the expected outperformance of a leveraged risk-parity strategy is sufficiently robust to changes in expected returns, risk, correlations, and the level of risk-free rates relative to historical experience. It also raises the question of whether ATP's stakeholders have sufficient mettle to set aside peer risk and sufficient risk tolerance to stay the course with non-traditional strategies during periods when performance can diverge materially from peers for several years.

In the latest articles—[Hebsgaard, Ramlau-Hansen, and Rangvid \(2025b\)](#) and [Japhetson et al. \(2025a\)](#) and [Japhetson et al. \(2025b\)](#)—there is a particular focus on payout profiles in the retirement phase and the impact on the attractiveness of different investment strategies. In ATP, actual payouts consist of nominally guaranteed benefits, which are expected to be relatively flat in real terms due to bonus write-ups. The models used by both groups of authors ensure that the pension system is self-financed, in the sense that members pay contributions and receive benefits, with no additional contributions from non-members and no undistributed assets remaining after the death of the final member. A shared feature of the models is that the pension system can be seen as being in a run-off. This contrasts with a pension system modeled as a going concern, where the scheme is assumed to operate indefinitely, with ongoing inflows of new members and contributions rather than gradually winding down. Another shared feature is the presence of two accounts: a savings account (corresponding to the Guaranteed Benefits) and an account for the Bonus Potential. However, the authors adopt different modeling assumptions regarding payouts during retirement.

Our understanding is that in both modeling approaches compromises arise because the pension scheme is not specified as a going concern. Nevertheless, insofar as both approaches ensure a self-financed system, they may be considered internally coherent, and the retirement phase is important for an evaluation of the models. However, the modeling assumptions complicate the comparison of the specific payout profiles across models. As HRR note, bonus payments would differ in a going-concern framework, and the calculations should therefore be interpreted with this caveat in mind.

The calculation in our evaluation avoids these problems as we use ATP's ALM model (see, for example, [Section 7.4](#)). ATP's ALM model has the more appealing feature of a going concern.

In addition, it has a rich modelling of the term structure of interest rates. This is crucial for understanding risks in investing in respectively short- and long-term bonds (see Section 4.1.5).

8.3 Criticism by Grosen and Raaballe

Grosen and Raaballe (2020) focus on ATP's capacity to preserve purchasing power. They argue that, given the prevailing levels of interest rates, which were negative at the time of their article, and inflation and the existing set-up, ATP would not be able to preserve the purchasing power of pensions.

They disagree with, but note the common claim, even among semi-professionals, that investing in equities has a higher expected return than investing in a risk-free asset, and that with a long investment horizon, bad years are evened out by good ones—so that a stock portfolio is typically no riskier than the risk-free asset in the long term. They show that, comparing a pure equity portfolio with a risk-free investment over a 25-year horizon, there is a 20–30 pct probability that the equity portfolio will generate a lower return in absolute terms. They consider such an outcome very unfortunate from the perspective of both the most disadvantaged pensioners and the state. In such a situation, the state will probably have to step in and provide more for the most disadvantaged pensioners. Pensioners with the capacity to invest and borrow can reverse ATP's decision to invest safely by taking on more risk in their occupational pensions, annuity pensions, retirement savings, and free funds. The most disadvantaged pensioners cannot, as they have neither wealth nor access to credit.

They therefore argue that the state and the most disadvantaged pensioners must prefer that ATP be turned into a resolution fund investing in risk-free assets. Grosen and Raaballe propose that ATP should invest in inflation-indexed bonds and that ATP contributions should be indexed by a factor linked to inflation (or wage inflation) and increase in life expectancy, divided by the nominal risk-free rate. In an environment with negative real rates, contributions would be increased not only with inflation but by more, to compensate for the erosion of real value caused by negative real rates. When real rates rise, ceteris paribus, contributions would not need to increase as much. This would allow ATP to invest in risk-free assets, since contributions would ensure the desired level of purchasing power at retirement. In addition, the authors suggest a one-off increase in contributions by a factor of 3.5 to 4.0 to reach a desired level of pension payments.

Raaballe (2025) cites ATP's stated purpose: "In 1964, the Danish Parliament (DP) decides to establish the Labor Market Supplementary Pension (ATP). The DP estimates that the state pension will be a heavy expense for the state and want the elderly to be guaranteed a certain

level of support. This will be done by everyone—through ATP—saving up for their own old age” (from ATP’s homepage). Raaballe argues that, 62 years later, none of these goals come close to being met. For the most disadvantaged pensioners (about 30 pct of pensioners), the ATP pension after tax amounts to 7 pct of their income; for the most well-off pensioners (about 30 pct of pensioners), ATP accounts for 1 pct or less. For the 30 pct of pensioners who in the future will rely largely only on the state pension and ATP, the state will bear virtually the entire support burden—61 pct in the form of state pension and 32 pct in means-tested benefits such as housing benefit, elderly check, heating subsidy, green check, and media check—handling 93 pct of the total support.

To relieve the state’s dependency burden, Raaballe argues, ATP contributions must be increased at least fivefold. This would achieve the purpose of reducing the state’s dependency burden, but only some 40 years from now—more than 100 years after the adoption of the ATP Act. He finds it difficult to see the social partners taking that path.

We note that the authors define inflation indexation as the case in which the real value of pension savings matches the value of pension contributions. This differs from ATP’s definition of inflation indexation, which refers to indexation of the tariffs. We agree with the authors that achieving the inflation indexation objective, as they define it, required substantial downside risk during the period of negative real rates. Developments in real interest rates since the article was written have made this objective somewhat easier to attain.

We agree that ATP’s relatively limited importance makes it difficult to regard ATP as a meaningful source of diversification of pension income. We acknowledge that the proposed indexation of contributions is a stand-alone mechanism that can deliver the desired level of purchasing power without investment risk.

We are skeptical of the proposal that ATP invest exclusively in risk-free assets. There is a case for including equity exposure for low-income earners, who typically have limited equity exposure in their overall portfolios. We note that the recommendation of Grosen and Raaballe contrasts with that of Ramlau-Hansen and Rangvid. We take an intermediary view that ATP’s risk-taking should be guided by the implied standard of Solvency II.

8.4 Other points raised to the Evaluation Group

We interviewed 17 individuals or organizations, in addition to HRR, who have expressed views about ATP in various contexts. The views differ and span ten topics, some falling outside our mandate. We are grateful to those who provided input. Because much of it was given in a personal capacity, the views are presented by topic rather than by source.

8.4.1 Role of ATP

The first topic is the role of ATP within the pension system. There is a general view that ATP has a role to play, particularly for individuals without other sources of pension income. At the same time, there is a view that ATP must find its own role within a pension system that has evolved since it was founded—not least with the advent of Pillar 2 pension funds, which now cover large segments of the population. Some view an ideal pension system as one that combines multiple sources of pension payments, thereby diversifying the risk to pensions if one source underperforms. Others view ATP as having a particular role in reducing the government's responsibility for supporting “free riders” who have not saved sufficiently for retirement, thereby limiting government expenditure on Pillar 1 pensions. A further view is that ATP should provide an inexpensive, basic, and guaranteed pension, leaving Pillar 2 funds to tailor products more closely to individual preferences.

We agree that ATP has a potential role to play as a source of diversification of pension income. (Since ATP's pension is guaranteed and incorporates mortality risk, it represents a floor for individuals' pensions.) However, ATP is currently too small to play this role meaningfully—unless contributions were to increase significantly, which is outside our mandate. ATP has a comparative advantage as a very inexpensive source of pension income, and it has a special role to play for those who do not otherwise save for retirement, helping to reduce government expenditure on Pillar 1. We also agree that low-income earners should have some exposure to equity markets.

8.4.2 Comparative advantages of ATP

The second topic is ATP's comparative advantages. ATP has the advantage of scale and potentially the capacity to negotiate low fees. It also has a comparative advantage in generating liquidity from the Interest Rate Hedge Portfolio and using it to take leveraged positions in the Investment Portfolio. Some observers are nonetheless skeptical of the use of leverage, and others note that leverage is not permitted in some other jurisdictions (for example, the AP funds in Sweden) although it is common in the Danish pensions industry.

We consider it important that ATP make use of its comparative advantages. The use of leverage to arrive at the optimal portfolio is consistent with financial research. At the same time, we note the potential operational challenges when leverage is high, or when high leverage is combined with large illiquid asset positions. Leverage should be assessed in relation to the entire balance sheet rather than the Investment Portfolio alone and viewed in the context of an investment organization's capabilities. To this end, the use of suitable unlevered and levered benchmarks would be useful for reporting performance and managing active value-added

strategies.

8.4.3 Investment strategy

The third topic is ATP's Investment Portfolio in general. There is broad agreement that the Investment Portfolio should reflect pension objectives, but views differ on how much risk ATP should take and on what constitutes risk. (This question is closely related to the question of leverage above.) Some argue that ATP should be a low-risk investor, while others see scope for taking more risk through a more diversified portfolio. Some regard increased risk-taking as necessary in the low-interest-rate environment that has prevailed since the Global Financial Crisis, while others regard equities as low-risk investments in the long run. Several consider illiquid assets to account for too large a share of investments, making rebalancing difficult. Some see the split into an Interest Rate Hedge Portfolio and an Investment Portfolio as a success. It is also noted that Swedish and Dutch pension funds have increased their allocation to equities and illiquid alternatives while decreasing their allocation to bonds.

We strongly believe that the investment strategy should be determined by pension objectives. We find that a very risky Investment Portfolio is necessary to meet ATP's stated objective of inflation indexation, but too high a level of risk may take the Investment Portfolio outside what can be considered prudent. The actual choice should balance these two considerations. We believe that the allocation to equities and bonds must be based on portfolio management models, including assessment of their robustness. The split into an Interest Rate Hedge Portfolio and an Investment Portfolio is grounded in finance theory (see Chapter 4).

8.4.4 Communication

The fourth topic is the relationship between the complexity of the ATP model and the communication of ATP's performance. Many commentators find the investment model highly complex, which makes it difficult to communicate results clearly. The difficulty is compounded by the fact that ATP's model differs from the market-based models that are increasingly the norm among Danish pension funds. There is a need for greater transparency, particularly for specific parts of ATP's investments such as equity. ATP should conduct regular external performance reviews and continuously evaluate its investment hypotheses. Experience from the Netherlands and Sweden confirms that communicating the performance of pension funds is generally challenging.

We agree that ATP's model has become very complex. We believe there is a need to explain ATP's contribution more in terms of the pensions it delivers than in terms of returns on sub-portfolios of assets. At the same time, sub-portfolios should have clear objectives, be carefully

monitored, and be transparently and regularly reported on. Investment hypotheses should be evaluated. Reporting should cover not just investment performance but also the value added to pensioners in terms of the pensions they receive.

8.4.5 Complexity and the Supervisory Board

The fifth topic is the capacity of ATP and its Supervisory Board to manage the complexity of the model. There is some concern that the complexity may exceed the capacity of ATP and its Supervisory Board, with the result that a relatively large degree of responsibility is left to management.

We find that the material provided to ATP's Supervisory Board, while of high quality, would be challenging for any Supervisory Board to absorb. The Supervisory Board's work would be facilitated by a greater focus on the objective relating to the pension and the risk to the pension—the ultimate objective is what the pension beneficiary receives. This would be consistent with the recommended changes to communication and is an approach from which other pension funds could also benefit. We generally find that ATP's staff are highly qualified, dedicated, and professional. The Supervisory Board's oversight role of management would be well served by regular external reviews that also verify the link presented by staff between pension objectives and investment policies.

8.4.6 Performance

The sixth topic is ATP's overall performance. Views here differ. Some find that ATP has underperformed and should be redesigned. Others find the criticism largely backward-looking. Still others speak of a perception that ATP has historically done well—though its communication of performance was opportunistic—but that the perception has recently shifted toward underperformance. Observers in the Netherlands and Sweden note that performance should be assessed with respect to liabilities: guaranteed liabilities require different evaluations than market-based products, and comparisons to unlevered pensions or to sovereign wealth funds without explicit liabilities are not appropriate.

We find that ATP has done well in hedging its guaranteed portfolio and has demonstrated operational excellence. The more recent performance of the Investment Portfolio has, by contrast, been mixed. That said, all investors and investment strategies face difficult periods from time to time. We agree that performance must be evaluated in the context of a pension fund's liabilities and should be communicated in a way that reflects the constraints imposed by the liabilities.

8.4.7 Inflation indexation

The seventh topic is inflation indexation. There is broad agreement that inflation indexation is a difficult and ambitious objective. Some regard it as highly relevant. Others suggest that ATP should be allowed to let the Bonus Potential temporarily take on negative values to enable higher risk-taking, making inflation indexation easier to achieve. Experience from the Netherlands suggests that inflation indexation is difficult to achieve.

We agree that the inflation indexation objective, while desirable, is too ambitious to be achieved through ATP's investment strategy alone. Allowing the Bonus Potential to take on negative values falls outside our mandate, but we note that it would significantly change the set of investment strategies that would be optimal for ATP and could, in an extreme case, put the taxpayer at risk. When it comes to a broader desire to secure a certain level of purchasing power or relevance of ATP pensions, a discussion of linking future contributions to inflation, or of a material one-off increase in contributions, is warranted.

8.4.8 Active risk

The eighth topic is deviations from the market portfolio. Some regard such deviations as questionable. Most agree that clear benchmarks are important when deviations from the market portfolio occur. Some question what they consider to be an excessive weight in Danish equities. Others argue that Danish equities generate excess returns, that ATP's role in the Danish market creates positive externalities through improved corporate governance, and that ATP's role in Danish financial markets and the pension system warrants a higher Danish allocation. Some further suggest that ATP and Denmark could benefit if ATP played a larger role in Danish venture capital. Swedish pension funds also have a relatively high exposure to Swedish equities, which they tend to justify by their better understanding of the domestic stock market.

We believe that ATP should explicitly aim to generate alpha relative to well-recognized passive benchmarks, given its size, skill set, and other advantages. While deviations from market portfolios can be encouraged, performance should be closely monitored against clearly defined benchmarks and accompanied by transparent reporting. ATP has historically outperformed in its Danish portfolio, but that portfolio suffers from the same illiquidity risks as the illiquid portfolio. Given ATP's low costs, it may be well positioned to play a larger role in Danish venture financing, but doing so could further complicate ATP's investment strategy and should occur only if it generates attractive risk-adjusted returns.

8.4.9 Contributions

The ninth topic is contributions to ATP. Most support an increase. Some suggest that ATP savings be transferable to other pension funds if ATP does not adopt a different model.

We note that increased contributions would strengthen ATP's role in the pension system, including providing a source of diversification of pension income. Subsequently indexing contributions to inflation, for example, would give ATP a better basis for maintaining this role in the future.

8.4.10 Governance

The tenth topic is the governance of ATP. Some point to conflicts of interest; others note the absence of pensioner representation. These issues fall outside our mandate.

Chapter 9

Communication of performance

Key message

ATP faces a challenge in communicating its performance as the public's focus is either on the return on the Investment Portfolio or the return on all its assets. The return on the Investment Portfolio is volatile as it is designed to take high risks. The total return reflects that more than half of the assets are set aside to hedge the liabilities. The liabilities are long-term liabilities whose value is primarily driven by long-term interest rates. Neither of the two perspectives conveys the right story on ATP's overall performance.

It is not an easy task to communicate something as complicated as delivery on a pension promise. As reviewed below, many agree that this is the right focus, but few manage to deliver. Most report on investment metrics. This is the case for both international funds and Danish funds.

ATP's primary performance indicator should be how well it delivers pension payments within the context of its obligations and as part of the overall Danish pension system. The two key metrics should be the pension it delivers, and the risk related to that delivery. These are the metrics that will be the focus of most of its members, including the more sophisticated.

The financially interested, including professionals, will want to understand how ATP delivers the pensions. Therefore, the performance of sub-portfolios and tactical overlays should be communicated but as second-order decisions and measured against the role of the sub-portfolio and relevant benchmarks. The results of the different portfolios should ultimately be shown to match the income statement and the new balance sheet.

Key message (continued)

There should be continuity and consistency between what is communicated and how the internal machine is set up. ATP must not succumb to the temptation to overcommunicate returns on the Interest Rate Hedge Portfolio when interest rates decline, nor should it overcommunicate returns on the Investment Portfolio when these are merely the result of the risk level. ATP should continuously make clear that its investment strategy will deliver a volatile bottom line but that this is the price for ATP's ability in the long run to deliver the best possible pension according to its remit at the lowest possible risk.

Together with ATP staff, we have made progress on communication, but work remains to be done. ATP should continue its work in this area and preferably with the input from external partners that can help build credibility for the approach.

This chapter discusses communication. Section 9.1 is a survey of what relevant pension funds in nearby countries and Danish pension funds communicate. Section 9.2 describes how ATP communication has evolved, and Section 9.3 shows that there are many misconceptions in relation to ATP that need to be corrected. Section 9.4 makes recommendations on how ATP could proceed.

9.1 What pension funds communicate

Key message

Across both Pillars and all countries discussed, pension fund communication revolves around investment returns, costs, risk management, governance, and responsible investment. There is generally less focus on pensions.

There are differences across pillars. At the Pillar 1 level, communication is systemically focused on the fund's contribution to national pension system stability. At the Pillar 2 level it is more member-facing and, in competitive segments, shaped by market positioning.

There are also differences across countries.

Norway's Government Pension Fund Global represents the frontier of what is achievable in institutional transparency, but its communication model is enabled precisely by the absence of the pension-specific complexities—liabilities, individual accounts, indexation—that other funds must navigate. The Netherlands seems to lead on cost disclosure standardization, driven by the Pensioenfederatie's recommendations and strict regulatory

Key message (continued)

oversight. Denmark's Solvency II framework makes regulatory capital metrics (SCR, solvency ratios, sensitivity analyses) uniquely prominent in Pillar 2 reporting, although it is increasingly less relevant as defined contribution funds become more important. Sweden's occupational providers emphasize cost efficiency and the default-provider model, while the AP buffer funds stand out for their collaborative sustainability reporting through the Council on Ethics.

The most significant ongoing shift across all three primary countries is from collective to individual communication. The broader trend, driven by the shift from DB to DC, digital platforms, and regulatory expectations for personalized information, is reshaping pension communication in all three systems. The challenge for all funds is to make complex financial and risk information accessible and actionable for members who may have limited financial literacy and limited engagement with their pension.

Pension funds communicate with their members, stakeholders, and the public through annual reports, interim reports, websites, digital platforms, and specialized publications. This section surveys what pension funds in Denmark, Sweden, and the Netherlands typically communicate, distinguishing between the statutory or buffer fund level (Pillar 1) and the occupational pension level (Pillar 2). Norway's Government Pension Fund Global (GPFG; also known as the oil fund) is included in the Pillar 1 discussion as a benchmark for transparency and communication practice. These countries consistently rank among the most transparent pension systems in the world (CEM, 2024; CEM, 2025). Despite this shared commitment to transparency, the content and emphasis of communication differ across the two pension pillars and across the countries, reflecting their distinct pension architectures.

9.1.1 Pillar 1: statutory pension funds and buffer funds

Pillar 1 pension funds serve the entire population or near-universal membership bases and are established by law, and this influences their communication. Their primary accountability is to parliaments and the public at large, though they also communicate with individual members. The communication style tends to be systemic, emphasizing the fund's contribution to the stability and adequacy of the national pension system.

Sweden—AP buffer funds and AP7

Sweden's Pillar 1 pension system has two components with distinct communication approaches. The buffer funds (today, AP2–AP4) manage the buffer capital of the income pension system,

while AP7 is the default provider in the premium pension system.¹⁰³ The AP buffer funds' primary audience is the Swedish Parliament and the public rather than individual members, who interact with the pension system through the Swedish Pensions Agency (Pensionsmyndigheten) and the annual "orange envelope" pension statement. The AP Funds manage the buffer capital on behalf of the Swedish Parliament and the Swedish people, for the benefit of current and future pensioners (AP1, AP2, AP3, AP4, 2025). Communication emphasizes total returns (absolute and relative to the income index, which determines pension rights), asset allocation across equities, fixed income, and alternatives, performance attribution by asset class, management costs, and net transfers to the pension system. Responsible investment and sustainability are also particularly prominent, and the funds publish separate sustainability reports in addition to their annual reports (see, for example, the joint reporting by [Council on Ethics for the Swedish National Pension Funds \(2025\)](#)). AP7, the default option in the premium pension system, communicates more directly with individual savers since it manages the accounts of more than four million Swedes (AP7, 2025). Its communication emphasizes the life-cycle investment approach (shifting from equities to fixed income as savers age) and its performance relative to private-sector alternatives in the premium pension system.

The Netherlands—no direct Pillar 1 fund equivalent

The Dutch Pillar 1 pension (AOW) is a pay-as-you-go state pension administered by the Social Insurance Bank (SVB), without an investment fund. Communication about AOW comes from the government and SVB rather than from a pension fund. The significant pension communication in the Netherlands therefore comes from Pillar 2, discussed below.

Norway—the Government Pension Fund Global as a transparency benchmark

*While the primary focus of this section is on the pension systems of Denmark, Sweden, and the Netherlands, we include Norway's Government Pension Fund Global (GPF) as a global benchmark for institutional investor transparency.*¹⁰⁴ Norges Bank Investment Management (NBIM) is the fund manager. NBIM's communication model sets the standard for institutional transparency. The fund publishes a complete list of all holdings, updated twice a year and available back to 1998, a real-time fund value counter on its website, quarterly and annual reports with detailed performance attribution by asset class, sector, and region, and a separate annual responsible investment report. NBIM discloses its voting intentions before each shareholder meeting, publishes detailed rationales for selected votes, and maintains named

¹⁰³In 2025, the Swedish Parliament decided to consolidate the buffer funds: AP1 was divided between AP3 and AP4, and AP6 was merged into AP2, effective January 1, 2026.

¹⁰⁴The fund's formal name is the Government Pension Fund Global. Despite the name, it is a sovereign wealth fund funded by petroleum revenues, not a pension fund in the traditional sense. The GPF, managed by Norges Bank Investment Management (NBIM), had a market value of NOK 21,268 billion at the end of 2025 (NBIM, 2026).

exclusion and observation lists with published justifications (NBIM, 2026). The fund also publishes expectation documents setting out its positions on corporate governance, climate, human rights, and other topics, and it regularly invites civil society to provide input on its responsible investment work.

The governance structure underlying this communication is a clear. The Norwegian Ministry of Finance sets the fund's mandate and reference portfolio (currently 70 pct equities and 30 pct fixed income), while NBIM manages the fund within defined risk limits. The annual report to Parliament is the primary accountability document, and the Ministry published its latest annual white paper on the fund's management to the Storting in March 2026 (Norwegian Ministry of Finance, 2026). The fund is also subject to periodic external reviews of its investment strategy and active management.

However, the GPFG differs from the pension funds discussed elsewhere in this section in a fundamental respect: it has no pension liabilities, no funding ratio, and no individual members—making communication far simpler. Its communication is about the stewardship of intergenerational national wealth rather than about pension adequacy for individuals. NBIM never has to communicate about indexation decisions, bonus ratios, solvency capital requirements, or individual pension projections—the dimensions that are increasingly central for ATP, the Dutch funds, and the Swedish occupational providers. In this sense, the most transparent fund in the world has a much simpler communication task, because it is free from the pension-specific complexities that the other funds must navigate. That said, the fund's mere size and global ownership lead to other communication challenges related to responsible investments and being perceived as an expression of Norwegian foreign policy rather than being a financial investor (Expert Council for the Government Pension Fund Global, 2026).

9.1.2 Pillar 2: occupational pension funds and providers

Pillar 2 encompasses occupational pension funds and commercial providers that manage pensions established through collective bargaining agreements or employer-sponsored schemes. Communication here is more directly member-facing and, often in competitive segments, shaped by the need to demonstrate value relative to alternatives.

Denmark—commercial pension companies and sector funds

As Danish commercial pension companies operate under Solvency II, their annual reports are substantially more oriented toward regulatory capital metrics than Dutch pension funds or Swedish occupational providers. Danish Pillar 2 pensions are provided by commercial pension companies (such as PFA, Danica Pension, and Velliv) and occupational pension funds (such as

PKA, Sampension, and Industriens Pension). Danica Pension, for instance, reports its solvency capital requirement (SCR) and total capital, alongside detailed sensitivity analyses showing how various stress scenarios (interest rates, equity, credit spreads) would affect the solvency ratio ([Danica Pension, Livsforsikringsaktieselskab, 2025](#)). Investment returns are reported separately for unit-linked (market-rate) products and guaranteed (average-rate) products, with the latter involving discussion of bonus reserves and interest rate hedging. Danish providers also publish Solvency and Financial Condition Reports (SFCRs) as required under Solvency II.

Beyond regulatory reporting, Danish commercial providers compete on investment returns, costs, sustainability credentials, and digital services. The sector has increasingly shifted from guaranteed products toward non-guaranteed (market-rate) DC products, which changes the communication focus from bonus reserves and guarantees toward investment returns, risk profiles, and life-cycle investment strategies ([Danmarks Nationalbank, 2025](#)). There is a trend towards digital communication. For example, PFA communicates through digital platforms and pension apps, emphasizing personalized pension projections and advisory services.

At the cross-provider level, all Danish pension companies and funds participate in PensionsInfo ([pensionsinfo.dk](#)). This is an industry-wide digital platform launched in 1999 and operated by Insurance & Pension Denmark. PensionsInfo allows every Dane to log in with their national digital identity and see a consolidated overview of all their pension entitlements—across ATP, occupational pensions, and private savings—including projected retirement income at different retirement ages. PensionsInfo represents a form of individual communication that complements the fund-level reporting described above. ATP and other funds can rely on PensionsInfo for providing important information.

Sweden—occupational pension mutuals and commercial providers

Swedish Pillar 2 pensions are organized through collectively bargained agreements, with default providers Alecta and AMF playing a central role. Alecta manages white-collar workers' DB plans and is the default option for their DC plans ([Alecta, 2026](#)). AMF manages blue-collar workers' pension plans and is run according to mutual principles ([AMF, 2026](#)). Alecta communicates a dual set of metrics reflecting its DB and DC portfolios: for the DB portfolio, the key reported figures are the collective consolidation level (a funding ratio governing bonus distribution), investment returns by asset class, and pension increases for retirees; for the DC product, Alecta reports returns at different risk profiles, expense ratios, and comparisons with competing providers ([Alecta, 2026](#)). Since 2023, risk management and governance improvements have become an explicit communication theme, following large losses on US bank equity holdings. AMF reports total investment returns, asset allocation, and management cost ratios, with low costs as one of its core value propositions ([AMF, 2026](#)). It frames its communication

around its default-provider role for blue-collar workers who do not make an active choice of occupational pension (AMF, 2025). Both Alecta and AMF produce integrated sustainability reports.

Beyond the default providers, commercial pension managers (such as Skandia, SEB, Nordea, and Handelsbanken) compete for active-choice DC capital. Their communication is more product-oriented, emphasizing fund selection, investment performance across multiple fund options, and digital tools. A distinctive feature of Swedish Pillar 2 communication is the competitive dimension around pension transfers. Members can transfer DC capital between providers, and much of the recent boom in pension transfers has been away from traditional providers such as Alecta and AMF and towards banks, sometimes linked to other financial products such as mortgage discounts. This has prompted default providers to publish reports on transfer patterns and to call for regulatory scrutiny, making transfer flows an explicit communication theme.

The Netherlands—sector-wide pension funds

The large Dutch sector-wide pension funds are the backbone of the Dutch pension system and produce some of the most comprehensive public disclosures of pension funds globally. The annual reports follow the disclosure practices recommended by the Pensioenfederatie (CEM Benchmarking and Top1000funds.com, 2024).¹⁰⁵ Arguably, the Netherlands shows best-in-class cost reporting with the highest country score in the GPTB (CEM Benchmarking and Top1000funds.com, 2025), with funds reporting management fees, performance fees, and transaction costs separated by asset class. The reporting should inspire ATP and other Danish funds.

The transition to DC schemes under the Future Pensions Act (Wet toekomst pensioenen, Wtp) is currently reshaping Dutch Pillar 2 communication. Pension funds PFZW, PMT, and bpf-BOUW switched to the new DC-based system on January 1, 2026, while pension funds ABP and PME plan to transition on January 1, 2027 (DNB, 2025). Under the new system, participants can see how much pension capital has been accrued for them, making it more transparent how much money has been set aside for each participant (APG, 2025). Communication is shifting from the collective (“how is the fund doing?”) to the individual (“what does this mean for your pension?”). As investment risk has shifted to the individual, outcomes are no longer guaranteed, and participants must now understand probability ranges, contribution levels, and the personal impact of their choices. The regulator AFM has identified pension communication as an area of intensified supervisory focus, requiring plain language, balanced risk disclosure, and personalized digital tools (AFM, 2025).

¹⁰⁵The Pensioenfederatie is a Dutch association of pension funds that promotes the interests of pension fund members and publishes recommended disclosure practices.

9.2 What ATP communicated in the past

Key message

Communication in ATP's annual reports has evolved from an initially positive and optimistic style, over a period of greater neutrality and moderation, and occasionally back to positivity when financial results warranted. The overall trend in recent year points towards a balanced and prudent approach, with management increasingly focused on delivering clear, factual, and objective information to stakeholders.

However, the focus has consistently been on financial returns and the more sophisticated observer, rather than the core delivery of stable pensions and the members. There is a need to apply a more stringent and relevant set of key financial metrics to summarize the overall value creation of ATP Lifelong Pension for the members.

ATP communication is shaped by an unusual balance sheet structure. This creates a communication challenge, because the investor's main value—the interest it earns on its guaranteed pension provision—is not always reflected in financial reporting, as communication tends to focus on the result of the Investment Portfolio.

This section presents a short overview of how ATP's communication of its financial results has shifted over time. Specifically, it studies ATP's annual reports since 2002 and looks at the wording and framing in management's review of the year. It also takes a brief look at how financial metrics are conveyed in the annual reports to present the results. Note that the analysis is high-level and looks for general trends—and thus no strict methodology is applied. The framework conditions for ATP markedly changed in 2002 with the introduction of market-based accounting of pension liabilities in Denmark. Hence, this year marks a natural beginning for an investigation of ATP's communication of the financial results. The study is solely based on the annual reports as these constitute the main part of ATP's communication. We do not consider online communication, as ATP has not used its webpage for an active communication of financial results towards its members. Instead, the webpage has mainly served as an "archive" for press briefings, financial reports, company policies, and various additional material.

Trends and focus

For the first 10 years following 2002, management's communication in the annual reports was overall positive. The wording often emphasized success, achievements, and strong performance. Besides solid financial results, international awards and member satisfaction were also highlighted. This communicative approach helped to create an image of ATP as a confident organization during these years. Additionally, from 2009 the annual reports introduced a com-

parison of financial results with the rest of the Danish pension sector. The comparison was based on the return metric N1 from the Danish Financial Supervisory Authority, which measures return on all assets—including the Interest Rate Hedge Portfolio. Due to a period of falling interest rates in the aftermath of the Global Financial Crisis in 2008 (Section 7.2), the performance of ATP was strong versus the Danish pension sector.

From 2013 and onwards, there seems to be a strategic shift towards a moderate and neutral tone in the reports. The language became less enthusiastic, with management adopting a more balanced approach in their reviews. For instance, new value creation metrics were introduced in the reporting in 2013 as the N1-metric was no longer deemed optimal by the ATP management in representing the value creation for the members. This signals a move towards greater transparency and objectivity and a focus on the long-term financial results. The performance comparison versus the remaining Danish pension sector continued in the annual reports until 2014 and was then abandoned. Note that ATP's financial results were decent during these years and hence the shift towards more moderate communication cannot be attributed to poor performance.

For the period 2019–2021 ATP delivered strong investment results, and this development is reflected in the annual reports, where communication again became positive. Management emphasized achievements and favorable outcomes, echoing the earlier trend of highlighting success. The upbeat messaging during these years was linked to ATP's financial performance with headlines such as “record-high returns.” Another observation of the line of communication in this period is that ATP's annual reports shifted towards a focus on high-level strategic initiatives such as sustainability and ATP's business model. A stringent presentation and description of key financial metrics were downplayed compared to previous years.

The reports from 2022 to 2024 reveal a return to a neutral and balanced style of communication. Management's reviews focused on providing clear descriptions of ATP's activities and results. This suggests a commitment to transparency and prudent communication and should be seen in the light of ATP's challenging investment results in this period. However, the use of financial metrics with respect to communicating the returns and value creation for the members still appeared deficient.

In its latest annual report (The ATP Group, 2026) and interim communications, ATP reports investment returns relative to its Bonus Potential (the free reserves above guaranteed liabilities). The bonus capacity (the relationship between Bonus Potential and liabilities) serves as a central indicator of financial health. ATP emphasizes results over 10-, 20-, and 30-year time frames, as its obligations to Danes are lifelong and guaranteed. ATP also communicates interest rate hedging effectiveness, responsible investment, detailed holdings disclosures, and cost

efficiency.

9.3 Misconceptions about ATP

Key message

There exist many misconceptions about ATP in the public debate. They range from ATP's role to more detailed topics related to its investment strategy, returns, performance, and costs. There are also misconceptions about the implementation of ATP's investment strategy, like ATP's equity exposure. These topics are debated publicly, but often the debate is based on incomplete information or misunderstandings.

It is ATP's responsibility to improve the public's understanding of ATP, not least to increase the public's focus on the pension it delivers.

There are many misconceptions about ATP, and they recur in the public debate among different stakeholders. The misconceptions are understandable given the complexity of the ATP product and the ATP architecture. However, they also show that ATP needs to put more effort into explaining its business model and investment strategy.

It is ATP's responsibility to improve the public's understanding of ATP. This applies to everyone from the individual member to the more professional observers. The primary focus should be on the pension delivered and the risk to that pension. This requires consistent storytelling that does not shift with recent performance, and that acknowledges up front both the advantages and the disadvantages of the chosen strategy. As a public organization, ATP should hold itself to a high standard here.

This section lists some of the misconceptions about ATP that have arisen in different contexts and addresses the underlying misunderstandings. The examples are not intended to be exhaustive, and they are addressed without reference to their origin. They should be seen as examples of comments, questions, or conclusions from the public debate around ATP that need clarification, and hence as areas where ATP could strengthen its communication.

Misconception: ATP is a sovereign wealth fund

It is sometimes assumed that ATP is a sovereign wealth fund along the lines of Norway's Government Pension Fund Global. The implication drawn is that ATP should finance projects that are in "the public interest," for example the green transition or entrepreneurial ventures and start-ups.

However, ATP is fundamentally different from a sovereign wealth fund. A sovereign wealth

fund manages public wealth on behalf of the state, often derived from fiscal surpluses or natural resource revenues. ATP manages pension wealth on behalf of its members and has pension obligations to them. The wealth comes from two sources: contributions from members and returns earned in the financial markets. Hence, even though ATP is established by law, the wealth belongs solely to the members, and ATP should invest with the members' interest in mind. This does not preclude ATP from taking broader societal considerations into account where they are consistent with its mandate (see Sections 6.1.5 and 7.3.5), but ATP's investment strategy should be judged by whether it improves pension outcomes for members, not by whether it finances public policy objectives.

Misconception: ATP can be compared directly to Danish market-rate products

It has become common for financial journalists and academics to compare the financial performance of Danish pension funds. This is especially the case for the market-rate products, which have become dominant in Denmark (Section 4.6.2), making it easier for members to identify their own pension return and follow the development of their personal pension account. Comparisons between these products are therefore made routinely and published, and ATP is increasingly included in them.

Such comparisons are informative, but a raw return comparison between ATP and a market-based Danish pension fund is not meaningful on its own, because ATP's role in the Danish pension system, its pension product, and its investment strategy all differ. Given that role, product, and strategy, there is no single natural peer, since no investor shares all of ATP's characteristics (Section 7.7.7). On the liability side, the closest comparators are the Danish pension funds with guaranteed products (for example, Pension Fund for Teachers or PKA); on the investment approach side, they are the risk-parity asset managers. ATP performs its own comparisons against the Danish market-rate products to build internal knowledge, and reports them twice a year to ATP's risk committee and annually to ATP's Supervisory Board. These peer comparisons are shown in Section 7.7.7. They should be read alongside the risk adjustment set out there, since ATP's Investment Portfolio runs at a substantially higher risk level than the high-risk market-rate products.

Misconception: ATP is expensive

ATP is regularly characterized as being expensive and inefficient. This description could be rooted in some of the stories about large performance fees paid to the underlying fund managers in ATP Private Equity Partners, and in the misunderstanding that mandatory contributions lead to weak cost management. The lack of competition for the pension contributions that ATP attracts sometimes leads to the conclusion that ATP is managed on a less efficient

basis than commercial funds.

However, ATP is inexpensive in an international comparison and ATP costs less than half of the average Danish fund (Section 7.7.8), with both administration and investment costs being low. On remuneration, ATP's Group Management has a fixed salary and no variable pay. Moreover, performance fees related to private equity investments in ATP Private Equity Partners are mainly paid to the general partners in the underlying funds and only when financial performance has been strong. In addition, the management fees in ATP Private Equity Partners are low compared to other fund-of-funds. Low cost does not mean that no manager fees are paid anywhere; ATP can be low-cost overall while still paying fees—especially if those fees are tied to outperformance of managed portfolios by external managers in specific investments.

Misconception: ATP's use of leverage is an extreme strategy

ATP's use of leverage is occasionally described as an opportunistic and risky strategy, implemented through external financing.

The use of leverage allows ATP to harvest one of the few free lunches in financial markets—diversification. Leverage is used to scale an efficient portfolio to a desired risk level, which is in line with financial theory (Sections 4.4 and 6.6). A diversified portfolio with exposure to several rewarded sources of risk can have a better risk-return trade-off than an unlevered portfolio dominated by equities. Scaling that portfolio can therefore achieve better long-run results than taking the same risk through a more concentrated equity portfolio (Section 4.4.1). In this sense, leverage is an implementation tool used to obtain desired risk exposure, not an investment strategy in and of itself. ATP's leverage comes from the available cash in the Interest Rate Hedge Portfolio and from ATP's Treasury implementation, as described in Sections 6.6.2 and 6.6.3. ATP mainly implements leverage through derivatives and internal balance sheet funding rather than external borrowing. Leverage does introduce risks of its own, in particular funding and liquidity risk in stressed markets. It is therefore valid to discuss the overall level of investment risk in the Investment Portfolio and how the funding of that risk is managed, but the use of leverage itself follows from ATP's product design, desired risk level, and diversified portfolio construction.

Misconception: ATP has not delivered a return above inflation

It has been stated that ATP's return has been lower than inflation.

That is not true of the return on ATP's wealth, which has strongly outperformed inflation over the long run (Section 7.5.1). As Section 5.4 points out, there are two places where inflation enters ATP's objectives. First, expected inflation is embedded in the calculation of the tariffs

used to calculate the defined pension. This pension guarantee is a nominal guarantee, and the nominal interest rate reflects expected inflation, a real rate component, and risk premiums (Section 5.4.2). Second, ATP seeks to compensate for realized inflation after the guarantee has been granted through bonus allocations. The first objective requires ATP's total wealth to grow, on average, at least with inflation, and it has been met. The second objective is much more challenging because the nominal guarantees already embed expected inflation, so indexing them further asks the portfolio to deliver inflation twice—expected inflation in the tariffs and realized inflation on top of that. The misconception reflects the second objective, not the first. ATP's guarantees are nominal, and over a period of high inflation, the real value of an already-granted guarantee falls, even when the return on ATP's wealth is high. The mechanism intended to address this is the granting of bonus, which allows guarantees to be increased when the Bonus Potential permits (Section 5.4). The additional write-ups of the guarantees to realized inflation have not fully kept pace—from 2008 to 2026 cumulative inflation was about 36 pct against write-ups of roughly 18 pct for old-age pensioners (see Exhibit 5.10). This distinction between the two inflation objectives should be made more explicit. ATP's investment return has been above inflation, but it has not translated into additional realized inflation indexation of the guaranteed pensions, which already incorporates expected inflation at the time of the pension contribution.

Misconception: ATP does not evaluate its performance, as no specific benchmarks are published

ATP does not publish its investment performance versus specific benchmarks. This seems to have led to the perception that ATP does not have any evaluation or assessment of its own performance.

ATP has a comprehensive process for evaluating investment performance, which involves a range of internal stakeholders including the Supervisory Board. As part of the evaluation, ATP's performance is compared to different reference portfolios, and the drivers of returns are attributed to the underlying risk exposures. ATP, however, does not have traditional investment benchmarks like 60-40 equity-bond benchmarks or market capitalization benchmarks. A published yardstick is nonetheless a reasonable request, and ATP could strengthen its communication by setting out more clearly which reference portfolios it evaluates itself against and what the results of that evaluation have been.

Misconception: ATP's Investment Portfolio has delivered a low return

The large loss in ATP's Investment Portfolio in 2022 has supported the assertion that the portfolio has generally underperformed.

ATP's Investment Portfolio has outperformed the other Danish funds (Section 7.7.7). Against Danish market-rate products, ATP's raw investment-portfolio return has been high, but this largely reflects a higher risk level. On a risk-adjusted basis, ATP outperformed these peers up to 2022 but underperformed thereafter. Because ATP's strategy differs from that of most other funds, there will be periods of underperformance, and over time they should be outweighed by periods of outperformance. Inferring a verdict on the strategy from a single year is not sound. Whether the period since 2022 reflects an unfavorable environment for a diversified, risk-balanced portfolio or something more persistent is discussed in Section 7.7.4.

Misconception: The members in ATP would in the long run have been better off if their contributions had been paid into other Danish pension funds or into a simple common investment portfolio

The losses in 2022, in both the Investment Portfolio and the Interest Rate Hedge Portfolio led to a very large reduction in ATP's AuM. (We evaluate ATP's wealth accumulation in Section 7.5.1 and we compare it to Danish peers in Section 7.7.7).

Over the long run, the average member in ATP has not been made "worse off" by contributing to ATP. The accumulated wealth since the beginning of the century is comfortably in line with the wealth accumulation its members could have obtained at other pensions funds or life insurers. Had members invested their contributions in a classic 60-40 portfolio, they would not have been richer today. They would only have been moderately richer today if they had invested in a full equity portfolio, an investment strategy that has been unusual in the pensions industry.

Misconception: ATP's losses reduced members' pensions

ATP did experience relatively large investment losses in 2022, which was a year of extreme downside returns in both equities and fixed income. (We evaluate ATP's investment performance in this period in Section 7.7.4).

These losses in no way put members' guaranteed pension at risk: the Interest Rate Hedge Portfolio is managed to deliver the guaranteed pension cash flows whatever happens to interest rates, so the guaranteed pension floor is insulated from market moves (Section 6.2). In fact, when interest rates rise, the Interest Rate Hedge Portfolio can show large losses, but those losses correspond to a fall in the market value of the guaranteed liabilities. The misconception is to read hedge losses as failed investment performance rather than as the asset-side mirror of lower liability values. Investment losses can arise in the Investment Portfolio, which happened in 2022. Because risk in the Investment Portfolio is scaled to the size of the Bonus Potential (the CPPI-like dynamic of Section 6.4.3), a fall in markets reduces bonus capacity and ATP can de-

risk its Investment Portfolio, but this does not affect the already-granted guaranteed pension. Losses in the Investment Portfolio can narrow the scope for future bonus (Section 7.4)—and limit the write-ups of guaranteed pensions to meet realized inflation indexation—but it does not affect the guaranteed pension itself.

Misconception: ATP is doing a lot of “active management”

The fact that ATP's investment strategy differs from that of other Danish pension funds occasionally leads to the statement that ATP is doing a lot of active management of investments and is taking many “bets.”

ATP does not generally seek returns from picking individual securities. ATP's investment strategy is based on the diversification investment belief—ATP aims to spread investments across different asset classes, markets, and products instead of trying to “select the winners.” The key decisions are taken at the level of portfolio construction: which factors to be exposed to, in what proportions, and at what level of risk. The factor-based approach does not do traditional security selection (picking individual companies), but it results in significant deviations from market capitalization portfolios (as shown in Sections 6.3.3 and 6.3.4). It is these factor decisions—which factors to harvest, and at what risk level—and not security selection, that make ATP's portfolio look different from its peers. Within individual portfolios, ATP is largely a passive investor. The main exception is Danish equities, where ATP does more active stock selection (see Section 7.7.2), but this approach is not predominant in the remainder of ATP's portfolios.

Misconception: ATP has lost money on illiquid assets

There have been some large illiquid asset deals that ATP in which ATP has done poorly, and these have understandably attracted public attention. However, they should not be confused with the performance of ATP's illiquid portfolio as a whole.

ATP's illiquid assets have overall delivered positive returns and have outperformed the relevant liquid-market equivalents used in ATP's performance assessment (Section 7.6.5). ATP also has two success stories in private markets—ATP Real Estate and Private Equity Partners—with Private Equity Partners, on average, matching or outperforming the direct program without extreme losses and at low cost relative to other funds-of-funds. Over the 2015–2025 evaluation period ATP has earned a positive, but modest, illiquidity premium of less than 1.0 pct per year over a comparable liquid reference. This premium is in line with ATP's own internal assumptions, but it is lower than the extra return that theoretical models suggest investors should require for locking up capital and giving up flexibility and rebalancing capability (Sec-

tion 4.4.4). The experience is therefore not that ATP has generally lost money on illiquid assets, but rather that some concentrated direct investments have performed poorly within a broader illiquid portfolio that has performed better.

Misconception: ATP has only equity exposure to a limited set of companies

ATP publishes the listed equity holdings by individual names, which has created the impression that these are its only equity exposures. They are not.

ATP's equity exposure consists of directly held positions and of index products giving exposure to a broad market portfolio, with a substantial share held through index investments, particularly in emerging markets. The published list covers only the direct holdings. However, investing in indexes limits the scope for exercising active ownership, which is part of the reason the direct holdings are published. ATP's total equity exposure does diverge from a global market capitalization portfolio, most visibly in a deliberate home bias, as discussed and evaluated in Section 7.7.2.

9.4 Communication recommendations

Key message

ATP's primary performance indicator should be how well it delivers pension payments within the context of its obligations and as part of the overall Danish pension system. The two key metrics should be the pension it delivers, and the risk related to that delivery. These are the fundamental choices that ATP's Supervisory Board makes for its members and should therefore be the first-order decisions of the Supervisory Board. These are the metrics that will be the focus of most of its members, including the more sophisticated.

The financially interested, including professionals, will want to understand how ATP delivers the pensions. Therefore, ATP's allocations to different portfolios and the level of risks it takes in these portfolios should also be reported but as second-order decisions that serve to deliver on the first-order decisions. The second-order decisions are also technically more complex than the first-order decisions and therefore more, but not exclusively, the purview of management. The Supervisory Board at a minimum has an obligation to control the more technical decisions. However, here the Supervisory Board will often need input from an independent third party. The reality in ATP and the supervisory boards of most pension funds is that the focus is more on the technical second-order decisions. This runs counter to the recommendations in [Danish Financial](#)

Key message (continued)

Supervisory Authority (2017).

There should be continuity and consistency between what is communicated and how the internal machine is set up. Objectives cannot be overcommunicated. The objective in terms of pensions and pension at risk should be on the front page of every piece of communication from ATP on its performance. And it should be there from now until the objective changes—that is to say, potentially forever. The internal communication should match the external communication. There must be no doubt among ATP staff on how the internal machinery should be set up and what should guide internal decisions.

The performance of sub-portfolios and tactical overlays should be communicated as second-order decisions and measured against the role of the sub-portfolio and relevant benchmarks. The Interest Rate Hedge Portfolio should be measured against how well it hedges the guaranteed liabilities. The Investment Portfolio should be measured against several benchmarks. It should be measured against a market portfolio with the same volatility and against a 60-40 portfolio. Tactical overlays should be measured against whether they deliver additional value.

The results of the different portfolios should ultimately be shown to match the income statement and the new balance sheet. This is not the focus of ATP's performance assessment. It is merely to show that the accounts balance. It is a control function.

ATP's communication challenge is distinctive: explaining a complex liability-driven investment strategy to a universal membership base that includes every wage earner in Denmark. It is easy to end up communicating complex investment metrics. It can also be tempting to focus on success stories.

Communication should always start with a focus on the member. ATP delivers a simple product—fixed lifelong pensions to its members. The member perspective could also be shown for selected birth years in the annual accounting statements, but there should also be consideration as to whether ATP's website should allow members to access the same by their own birth year. Obviously, illustrations are based on modelled individuals, that is, not actual individuals going to ATP's website. Here the relevant pages should guide members to PensionsInfo.dk for a statement of their exact expected benefits. At the same time, ATP would still need to communicate on the fund as a whole, as this is tightly linked to the regular accounting statements. We therefore split the communication into two aspects: first, the member perspective and second, the overall ATP perspective.

9.4.1 Member perspective

To facilitate the discussion of communication, we consider three target audiences:

- ***Person on the street.*** An individual who occasionally hears of ATP and would typically have a good number of years until retirement.
- ***Person interested in their pension.*** An individual who is interested in how much they would receive in pension. This individual would typically be close to retirement or even retired.
- ***Financially interested person.*** An individual who cares about financial risk and returns. They could be either far away or close to retirement. This also includes journalists, politicians, and other observers.

The presented communication to each type of individual should differ, such as in level of detail.

9.4.2 Person on the street

For the person on the street, it should be a simple metric focusing on the expected pension. A simple metric shows what is paid in compared to what will be paid out, see Exhibit 9.1. This could be further divided into what has already been paid in and what is expected to be paid in, as well as how benefits are divided between pension rights already allocated and expected future allocations of pension rights. This simple metric would focus on the expected future benefits, which is the key deliverable of any pension provider. It only alludes to uncertainty of future pensions by differentiating between already allocated pension rights and expected future allocation of pension rights. It neither shows the rate of return nor makes it possible to assess whether the return has been enough to ensure a return that exceeds inflation.

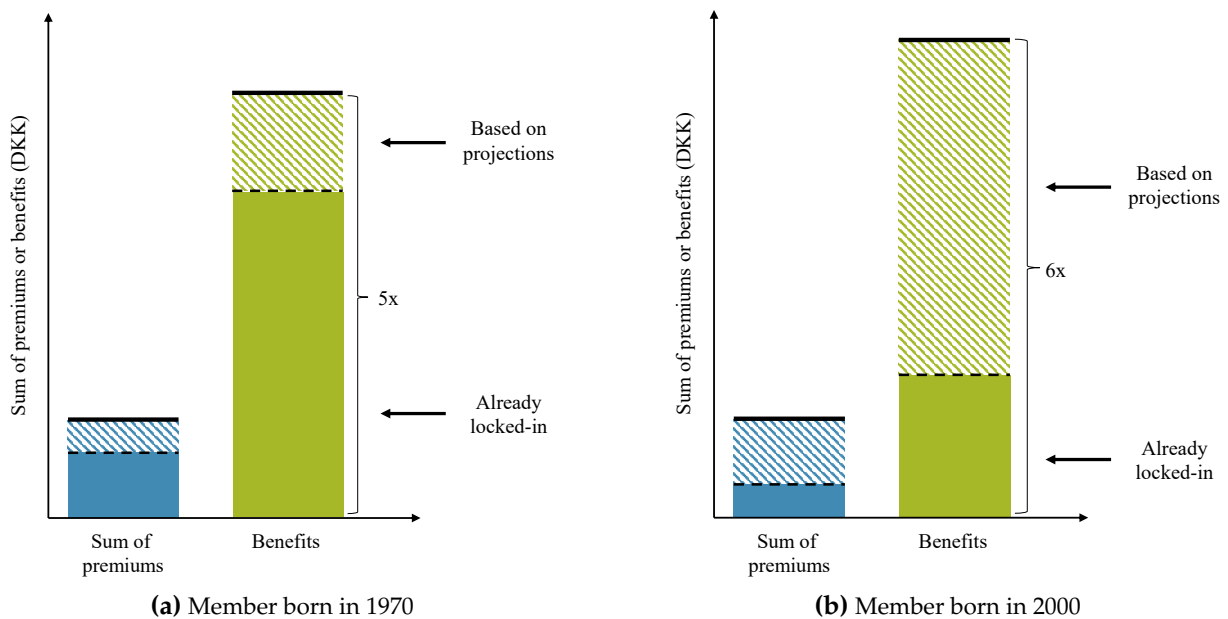


Exhibit 9.1: Simple value-creation metric for the “Person on the street.” The figure presents potential communication for the ‘Person on the street’, where emphasis is on simple metrics. The metric is a birth year based presentation and is a money-in versus money-out type metric. The left-hand column shows the expected total contributions made by the member, and the right-hand column shows the expected total pension benefits paid to the member. The columns are split into two: the solid-colored part is contributions already paid and already allocated pension rights. The shaded areas are future contributions and future allocations of pension rights. The latter is both due to the additional contributions, but also future bonuses. Note, the figure is based on illustrative, rather than actual, figures.

9.4.3 Person interested in their pension

For a person interested in their pension, the risk attached to the pension is the natural next question. The risk to the pension, the pension at risk, is an important decision of a pension provider. There will normally be a trade-off between expected pension level and the risk to that pension. The uncertainty is related to both future contributions and future returns, see Exhibit 9.2.

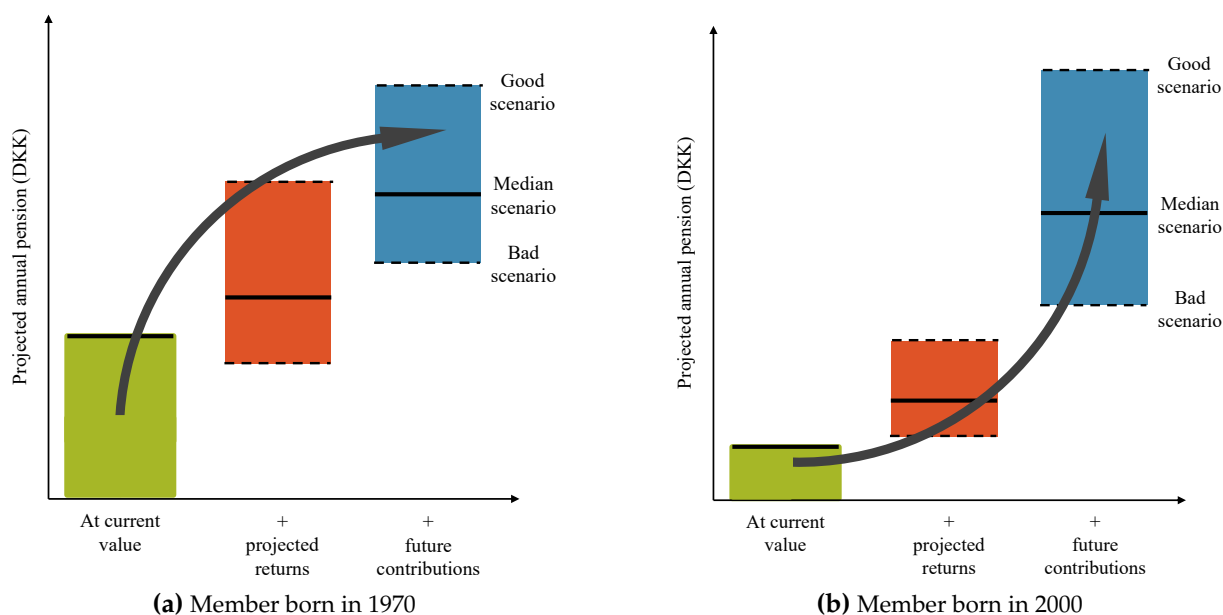


Exhibit 9.2: Value-creation metric for the “Person interested in their pension.” The figure illustrates the annual pension payments at current allocated pension rights (first column), including projected returns and bonuses (second column) and including future paid-in contributions. The figure also illustrates the pension-at-risk, based on the good and bad scenarios from official assumptions (that is, [PensionsInfo.dk](#)). Note, the figure is based on illustrative, rather than actual, figures.

9.4.4 Financially interested person

For the financially interested person, there is both an interest in the level of the pension but also an interest in how it was generated. Exhibit 9.3 illustrates the return ATP has already generated on paid-in contributions. In addition, it also illustrates the impact on the return over the rest of the life of the individual (or potentially until the retirement age). Furthermore, the returns are split according to source: 1) the guaranteed return, 2) the return from the annuity with market exposure, 3) additional return implicit in having extra reserves allocated due to longevity and 4) allocated bonuses. In a similar fashion, the same metrics can be applied to expected benefits, both on current paid-in contributions and including future contributions.

The financially interested person will also be interested in why returns differ across members. Members close to retirement have benefited from higher guaranteed interest, but also a larger number of bonus allocations. A larger part of their return has already been allocated. A younger member would have had more guarantees at a lower interest rate and seen fewer bonuses. For such a member a larger part of the pensions depend future returns. There can thus be a material difference between the realized return and the return when considered over the full life of an individual.

Review of ATP's Investment Strategy

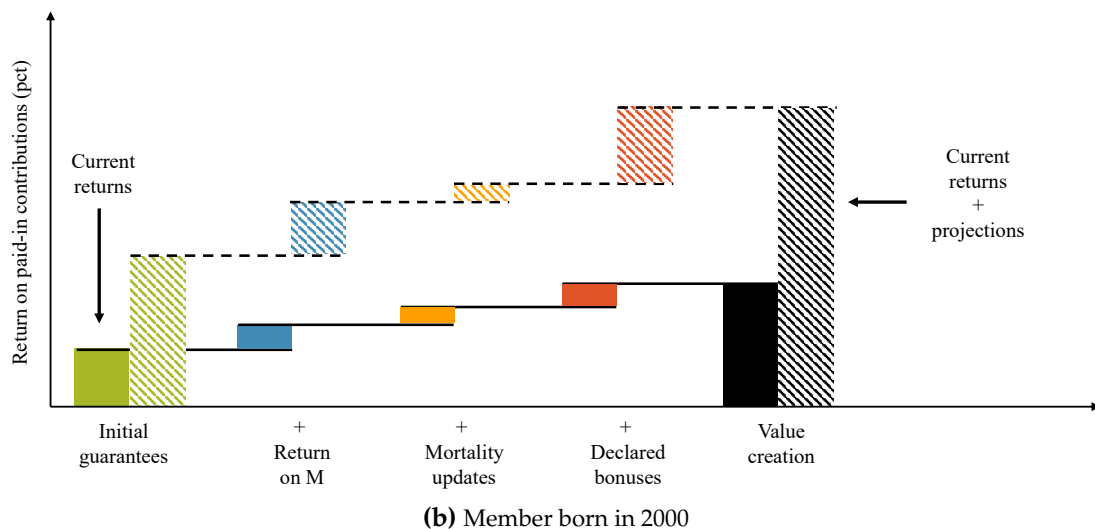
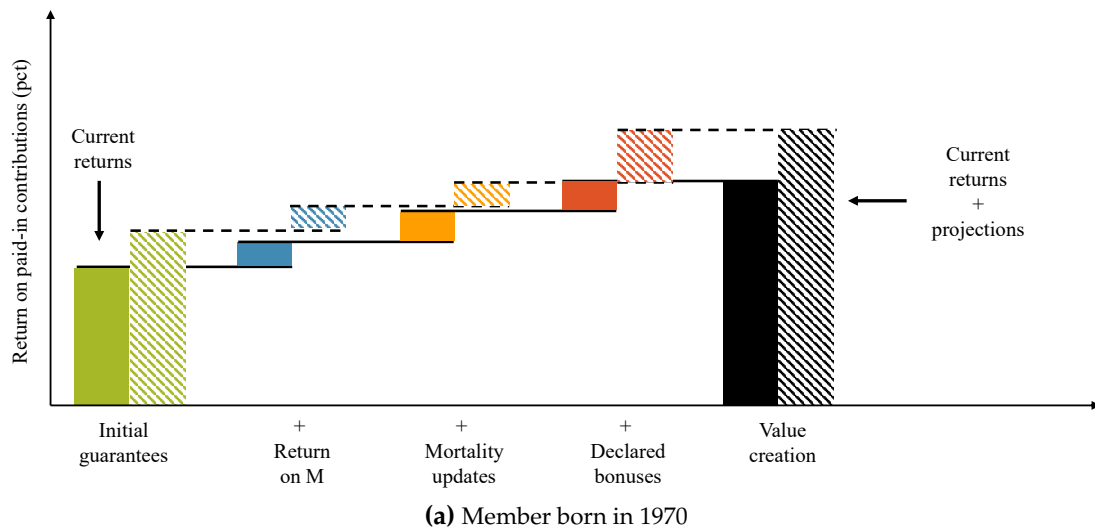


Exhibit 9.3: Current and future expected return for the “financially interested person.” The figure illustrates the return ATP has already generated on paid-in contributions. In addition, it also illustrates the impact on the return over the rest of the life of the individual (or potentially until the retirement age). The returns are split according to source: 1) the guaranteed return, 2) the return from the annuity with market exposure, 3) additional return implicit in having extra reserves allocated due to longevity and 4) allocated bonuses. Note, the figure is based on illustrative, rather than actual, figures.

9.4.5 ATP as a fund

When viewing ATP as a fund, the simple metrics can be repeated, but they would not be representative of a single member. Instead, when considering ATP as fund, the main purpose should be to link the value creation to the returns on the individual portfolios. First, value creation must be defined. A natural starting place is the cash flows for the members—both contributions and benefits. Second, it should reflect the changes in benefits due to bonuses but also mortality updates. Third, returns should also be clearly visible, such that it is visible if bonus allocations are due to returns in the period considered or due to prior returns. All of these elements must be contained in a value creation metric. Finally, the metric should be applicable both to shorter and longer evaluation horizons, such as 1 or 10 years or even longer.

Exhibit 9.4 illustrates how the decomposition of ATP's results could be performed. The section "Write-up of pension benefits" relates to already allocated pensions, either through guaranteed returns in the tariff, market return through the annuity with market exposure, mortality updates, or declared bonuses. The area "Unallocated investment returns" presents value creation in the collective unallocated funds and thus reflects the costs for the Bonus Potential of covering for longevity and allocating bonus to the members, but also the change in funding ratio due to investment returns.

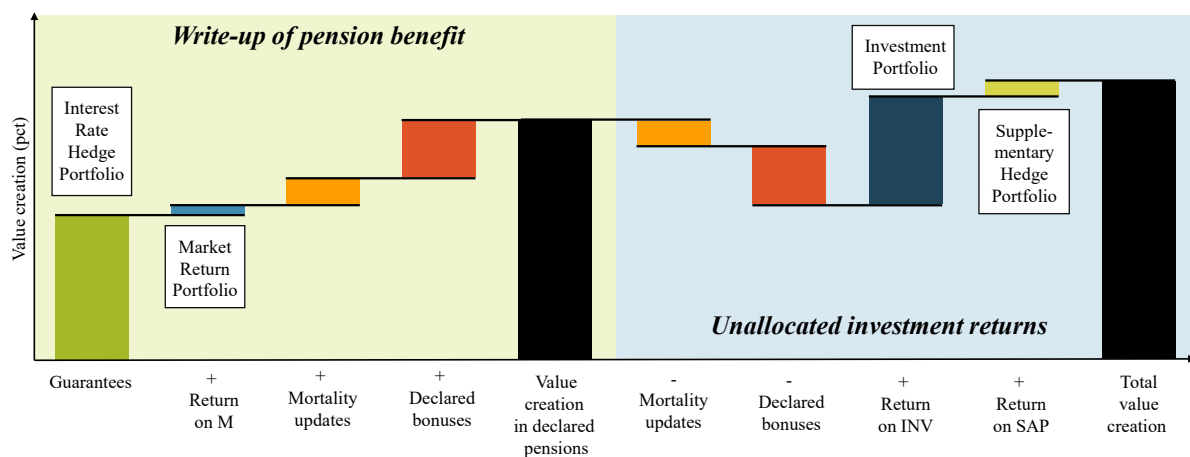


Exhibit 9.4: Decomposition of the overall value creation and its link to portfolios. The figure illustrates a possible value decomposition for ATP. The part 'Write-up of pension benefits' relates to already allocated pensions, either through guaranteed returns in the tariff, market return through the annuity with market exposure, mortality updates and declared bonuses. The area 'Unallocated investment returns' reflects value creation in the collective unallocated funds, hence it reflects the costs for the Bonus Potential of covering for longevity and allocating bonus to the members, but also the change in funding ratio due to investment returns.

The value creation is linked to ATP's portfolios. The value creation from having a lifelong pension is allocated as an equivalent investment return. The method distinguishes between funds allocated to pensions, and unallocated collective funds, and more importantly the transfers between unallocated and allocated funds. Finally, it shows which portfolios have generated the returns, and which makes it possible to allocate bonus (that is, transfer from unallocated to allocated funds).

The value creation can also be compared directly to ATP's objectives. Exhibit 9.5 illustrates how the total value creation, or just the bonus (and mortality) compares to the objectives of ATP, such as delivering money back (corresponding to a zero pct return) or meeting inflation, both in terms of the overall return or just the bonus allocation.

Review of ATP's Investment Strategy

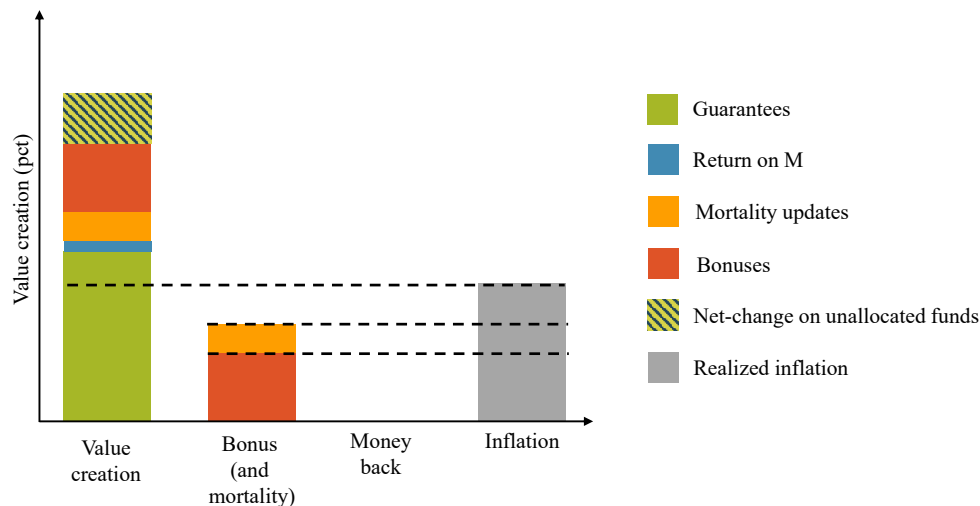


Exhibit 9.5: Comparing value creation to ATP objectives. The figure illustrates how the value creation in Exhibit 9.4 can be compared to possible objectives—here either money back (that is a zero pct return) or meeting inflation (that is a return after tax equal to the realized inflation rate over the considered period).

Following the presentation of overall value creation, the performance of individual portfolios could be presented relative to the relevant internal benchmarks. The Interest Rate Hedge Portfolio should be assessed against the guaranteed liabilities. The Investment Portfolio against risk adjusted returns on other strategies, including a 60-40 strategy. The Market Return Portfolio and the Supplementary Hedge Portfolio against their relevant risk adjusted benchmarks. Sub-portfolios and sub-strategies should be presented against their relevant risk-adjusted benchmarks. In addition, there should be measures of tracking error against minimum tracking error to avoid benchmark hugging where relevant.

Finally, the results of the portfolios should come together in the overall result. However, this should be more to show consistency in the reporting than to create a focus on the overall result.

Setting up a new complete reporting framework in detail will require additional work and the involvement of important stakeholders. We have worked closely with ATP, including the actuaries, on outlining the principles of a new reporting framework. However, more work is needed. It is important that the new framework can stand the test of time and from the outset is considered credible. Therefore, important stakeholders should be involved. These could include the DaneAge Association, which is the largest Danish organization for pensioners, including future pensioners.

Once the new reporting framework is set up, ATP should make it central to every presentation on performance. It is ATP's task to ensure that the public's perception of ATP mirrors how ATP works, including its criteria for success. The temptation to be opportunistic and shift to focus on other aspects must be avoided.

We are the first evaluation group to have assessed ATP's investment strategy, but we should not be the last. It is considered current good practice for pension funds to do external assessments. External assessments serve both as an input to management, as a control for the Supervisory Board and as communication to the public. They are part of an assurance that the funds are run in accordance with best practice. Our report is the first on ATP. Hopefully, it has provided a framework that subsequent assessments can build upon. As a result, they should be less lengthy.

Chapter 10

Conclusions and recommendations

This chapter starts with a summary of our analysis. It then provides important background for our recommendations. Lastly it presents eight recommendations. The order of the recommendations reflects the order of the analysis and not the importance of the recommendations.

10.1 Summary

ATP is a systemically important Pillar 1 pension provider—paying a guaranteed lifelong pension to almost all Danes from a fully funded balance sheet. Its provision of pensions should be seen in the context of the Danish pension system. ATP's pensions sit alongside the unfunded Danish state pension, which carries political risk, and alongside Pillar 2 occupational pensions, which have increasingly shifted toward non-guaranteed market-rate products. These developments in the Danish pension system have made ATP's distinctive features—lifelong prefunded guaranteed pensions, collective risk pooling, and the absence of surrender risk—all the more important.

This distinctive role played by ATP serves as the starting point in our evaluation of the investment strategy. ATP cannot be evaluated in the same way as another occupational pension fund that invests in a market portfolio because its purpose, product, and constraints are different. ATP's investment performance cannot be evaluated against a market portfolio because holding only the market portfolio would deliver pension outcomes inconsistent with its guaranteed promise. Because ATP's investment strategy differs from those employed by the majority of Danish pension funds, there will be years in which ATP underperforms. Appropriate evaluation of ATP's investment strategy therefore focuses on how its hedging strategy, asset mix, risk level, use of leverage, rebalancing, and performance of liquid and illiquid assets have delivered on the pension promise. The pension promise covers the guaranteed pensions and

the ambition to provide inflation indexation. It should be delivered in a way that maintains the ability to pay future bonuses, protects ATP's solvency, and sustains the long-run viability of its business model.

Behind ATP's simple pension product—lifelong guaranteed pensions—lies a sophisticated and complicated investment machine. This complexity reflects the ambitious combination of objectives and constraints that ATP must satisfy. The primary constraint is that 80 pct of contributions are set aside to fund the guaranteed pension, which earns a nominal return in force at the time of contribution. The remaining contribution is allocated to the Bonus Potential, which serves as a collective buffer and a means to provide write-ups to the nominal guarantee. The new business model introduces the Market Return Portfolio, which for members more than 15 years from retirement allows for direct market exposure on a portion of their contributions through a variable annuity (which provides a longevity guarantee but no interest rate guarantee) and the Supplementary Hedge Portfolio, which uses the value released by the illiquidity spread on the discount curve to support additional risk-bearing. The new business model has increased complexity.

The guaranteed pension is based on tariffs that already price in expected inflation and a real return. ATP strives to further index the pension guarantees to realized inflation. But only 20 pct of the contribution is allocated to a Bonus Potential that strives to meet realized inflation on the entire Guaranteed Benefits. ATP must therefore generate a very high return on the Investment Portfolio. This requires higher risk-taking in the Investment Portfolio than would be standard in other pension funds. ATP will meet its inflation indexation targets in most, but far from all, future conditions. According to ATP's internal asset liability management model calculations, the probability of meeting the inflation indexation target is 61 pct over a 10-year period where long-run inflation is 2 pct (see Section 7.4.4).

ATP's investment beliefs and overall investment strategy are largely in line with best practice and make use of ATP's comparative advantages. The major elements of ATP's investment strategy are the separation of the portfolio into an Interest Rate Hedge Portfolio and risk-taking portfolios, treating the level and composition of risk as a first-order decision, diversifying across a small number of rewarded risk factors, and prioritizing strategic over tactical asset allocation. They are grounded in modern portfolio theory and are consistent with ATP's investment beliefs. The use of leverage and derivatives to scale a risk parity investment strategy to a high level of risk exploits the comparative advantages of ATP's product. These elements of ATP's investment strategy set it apart from other pension funds. ATP has built a strong investment organization with a culture consistent with its investment beliefs, and the execution of the investments has been excellent with no major operational incidents identified during the

review.

Because the different parts of ATP's balance sheet serve different purposes, no single statistic can suffice to rate ATP's performance. The Interest Rate Hedge Portfolio should be evaluated by how well it protects the value of the guaranteed pension promises, not by whether it produces high stand-alone returns. The Risk-seeking Portfolios—the Investment Portfolio, the Market Return Portfolio, and the Supplementary Hedge Portfolio—should be evaluated by whether they generate adequately compensated returns at the chosen level of risk, to support future bonuses and inflation compensation without placing undue pressure on ATP's solvency. At the same time, the hedging of long-dated guarantees (partly through instruments that do not require full cash funding upfront) gives ATP low-cost funding capacity that supports the leverage used by the Risk-seeking Portfolios. This interaction is one of ATP's comparative advantages, but it also means that performance has to be evaluated at different levels: at the whole balance sheet, portfolio by portfolio, by investment strategy, and by the liquid and illiquid assets held by the different portfolios.

Taken at these different portfolio levels, the performance varies. From 2001 to 2025, ATP's balance sheet grew from DKK 245 billion to DKK 694 billion reflecting an average annual investment return on all assets under management of 5.6 pct.¹⁰⁶ A 60-40 portfolio of global equities and global bonds would only have grown the balance-sheet to a value of 656 billion in 2025, everything else equal. But from 2015 to 2025, the average annual return on all assets under management was only 0.8 pct per year compared to 6 pct for a 60-40 portfolio. In all years over the evaluation period, ATP's Interest Rate Hedge Portfolio has consistently met the requirements of ATP's pension guarantees and, in some periods, generated excess returns relative to the liabilities. Over the period from 2002 to 2025, ATP's Risk-seeking Portfolios outperformed a 60-40 equity-bond benchmark by 4.7 pct per year. But from 2022 to 2025, ATP's Risk-seeking Portfolios returned -5.8 pct per year, underperforming against a 60-40 portfolio that returned 4.5 pct per year. While ATP should monitor its performance relative to other funds and investment strategies, it should also maintain the best overall investment strategy that meets its liabilities and objectives, while remaining transparent about the implications for the volatility of the investment results and its relative performance.

There are elements within the overall investment strategy that need to be reconsidered.

The risk level in the Investment Portfolio is high. The volatility target is three times the volatility of a 60-40 equity-bond portfolio. This is higher than typical actively managed funds with long-only benchmarks and is comparable to the risk levels of some of the most risk-intensive

¹⁰⁶The growth rate of the balance sheet is not equal to the investment return on all assets under management due to cash flow effects arising from benefits paid and premiums received. The average return over the same period on the 60-40 portfolio was 5.6 pct, which is similar to ATP's investment returns over the period.

hedge fund strategies. This risk limit is also unusually high when measured against the 1-in-200-year solvency benchmark that is standard in the European pension and insurance regulation standards (Solvency II).

The addition of the Supplementary Hedge Portfolio has added both risk and complexity. Introduced partly with an ambition to increase returns, the Supplementary Hedge Portfolio is designed to exploit the value released by applying an illiquidity spread to support additional risk-taking. This exposes ATP's guarantees to new risks. ATP operates the Supplementary Hedge Portfolio with buffers that delay the transfer of gains and losses to the Bonus Potential. Sufficiently large losses reduce the Bonus Potential and may affect ATP's ability to meet the guarantees. Furthermore, the Supplementary Hedge Portfolio relies on ATP's ability to hold risky and illiquid assets through market downturns. The operation of the portfolio is also difficult to explain to members.

The high required return on investments, the risk of failing to deliver on the guaranteed nominal pensions or meet the intended indexation of pensions, the complexity of the investment strategy, and the operation of the Supplementary Hedge Portfolio all create reputational risk for ATP.

When ATP experienced losses in 2022, the share of illiquid investments was too high and led to concentration risk in the Investment Portfolio. In addition, the overall added return from illiquid investments has been less than 1 pct per year over the evaluation period, which is low relative to the return some economic models suggest is required to compensate investors for the complexity, governance burden, and the constraints on rebalancing associated with illiquid assets. ATP started to lower its investments in illiquid assets in 2020 and today it constitutes 17 pct of assets under management. The next step is to develop a framework for the optimal allocation to illiquid investments, improve its deal selection, and build a stronger performance assessment.

Within large direct private markets, there have been some investments that have performed very poorly. These deals were large and illustrate the dangers of concentration risk. On some metrics, private market investments have outperformed public market investments similar in size. But compared to market capitalization-weighted global equity benchmarks, ATP has realized little or no illiquidity premium. ATP's indirect investments in private markets through funds, managed by Private Equity Partners, have avoided extreme returns and have relatively low costs compared to other funds-of-funds.

Danish equities have a material overweight in ATP's investments relative to global equity benchmarks and, like with illiquid investments, can result in concentration and rebalancing

risk. As of year-end 2025, ATP had approximately 5 pct of its assets under management in Danish equities, constituting approximately 10 pct of risk in the Risk-seeking Portfolios. ATP's Danish equities have historically performed very well, and ATP plays a positive role in the governance of Danish firms. Home bias is also the norm among institutional investors. However, Danish equities also have some degree of rebalancing risk ATP should revisit the share of Danish equities and unless ATP can continue to demonstrate that its local advantages translate into better risk-adjusted outcomes for members, should reduce the home bias.

More generally, ATP should assign a more explicit role to returns in its investment policy, while still maintaining risk exposures. To date, ATP has not adopted benchmarks in its investment strategy. Benchmarks should be used to assess whether returns are being delivered, while incentives should remain aligned with harvesting rewarded long-run return premiums that are not fully captured in market capitalization-weighted benchmarks. Without explicit benchmarks, it is difficult to evaluate whether realized returns reflect the compensation expected for the risks taken, to distinguish skill from factor risk exposure, and to measure the value of active management beyond factor risk exposures.

ATP is a low-cost provider, yet this is one of several aspects of ATP that is poorly reflected in public discussion. In addition, the complexity of ATP's investment structure, the use of leverage and derivatives, and the separation between hedging and Risk-seeking Portfolios create misunderstandings about both performance and risk. Strong returns on the Interest Rate Hedge Portfolio during periods of falling interest rates have at times been interpreted as investment success rather than as a mechanical offset to a corresponding increase in the value of liabilities. Likewise, losses on the Risk-seeking Portfolios in volatile years have been interpreted as failures of strategy when they represent the foreseeable cost of an investment strategy that is structurally positioned to bear occasional losses. The resulting gap between perception and reality sometimes distorts the public debate about ATP's mandate and diverts attention from the long-horizon pension outcome that ATP is designed to deliver.

ATP needs to communicate its results in a way that focuses on the overall pension outcome rather than selectively highlighting performance in different sub-portfolios as has occasionally occurred in its history. Consistent, ex-ante framing of why ATP is structured as it is—and what members should expect in different market environments—would better align public perception with the underlying reality. This would in turn support better governance.

ATP has an important role to play in the Danish pension system and in many ways plays it very well. ATP has a different product in terms of its guaranteed nominal pensions, desired indexation of pensions, and component of market exposure, leading it to have a unique investment strategy. In our experience, ATP does better than many other pension funds in terms

of matching liabilities to assets, harvesting rewarded risk premiums, and not succumbing to peer risk. Also, ATP is more advanced in its thinking on pension objectives than most pension funds.

Our analysis and recommendations set a comparatively high bar. However, even if they are implemented, there will be years when ATP underperforms against other pension funds. That is the price of being different. But it is a price worth paying if ATP fulfills its role in the long run. Most of ATP's members will be around in the long run.

10.2 ATP's role in the pension system and implications for the evaluation

ATP's investment strategy must be assessed on how it delivers pension payments as a part of the overall pension system that has changed since ATP was established. ATP is a funded Pillar 1 pension provider. Its purpose is to generate a guaranteed, lifelong pension to virtually all Danes. ATP was established at a time when few Danes had occupational pension arrangements. Today, most Danes have access to occupational pensions, but a sizeable minority do not.

ATP must play a complementary role in the Danish pension system to justify its existence. Most Danes rely for their pension income on the Danish state pension and occupational pensions. ATP distinguishes itself from the Danish state pension by being funded. It distinguishes itself from the occupational pensions that increasingly have no guarantees by having a large, guaranteed component. The Danish state pension is subject to political risk, and the occupational pensions are subject to market risks. In principle, there is therefore a role to play for ATP in complementing both the Danish state pension and occupational pensions.

The challenge for this value proposition is that ATP's share of total pension income is small. This applies even for the sizeable group who have no occupational pension income as this group receives additional Danish state pension based on means testing. The most obvious way to resolve this is to raise ATP contributions for all; another way is to increase the contributions and subsequently the pensions only for the sizeable minority that do not have occupational pensions. The latter has been done but only on a limited scale. Contributions to ATP fall outside our mandate, but the role of ATP in the pension system and how it complements other sources of pension income is our starting point for evaluating the investment strategy. Our analysis therefore starts from the position that despite the relatively small size of ATP pension payments, ATP must deliver pensions that generate value for pensioners in the context of the overall pension system.

ATP should balance differentiating itself from the occupational pension schemes and, at the same time, provide value to those that do not have occupational pensions. The first objective supports having some guarantees. The second objective supports investing some of the funds in equities and alternative assets—sources of return to which individuals without occupational pensions are known to have limited exposure. Over the long run, these assets provide more inflation protection than long-term bonds.

ATP has three major comparative advantages.

First, ATP can offer a standardized pension product because it complements occupational pensions rather than substituting for them. Therefore, ATP is, for most members, a supplement to occupational pension schemes. It does not need to provide the same level of customization for those who have occupational pensions. Occupational pensions can be designed taking ATP's construction into consideration. This allows ATP to offer a simple pension product—a basic lifelong income stream. In this sense, ATP can be the Model T Ford of the Danish pension system—a standardized product that delivers reliable income for most people at scale.¹⁰⁷ This scale should make it possible to deliver a pension at a lower cost than the occupational pension schemes and thus contribute to the overall efficiency of the pension system. Below, we will conclude that ATP delivers on this comparative advantage.

Second, ATP's long-dated liabilities and its use of partially unfunded hedging instruments allow it to deploy capital efficiently. ATP's large guarantees are partially hedged by instruments, such as interest rate swaps, that do not require cash up front, and ATP's liabilities are long-term. ATP therefore sits on a large funding base that can be used to apply leverage in its Investment Portfolio at low cost. This allows ATP to run more sophisticated strategies than other asset managers who cannot take leverage or are restricted to long-only investment strategies.

Third, ATP's scale could in principle give it advantages in private markets. ATP is a large pension fund, at present the second largest in Denmark. This could give it negotiating power and a skill base that may be used in private markets, where smaller investors face higher costs or limited access. We circle back to this comparative advantage later and conclude that in practice this has not always generated excess returns.

ATP is constrained by the ATP Act in terms of its investment strategy, and an evaluation must take these constraints into consideration. ATP's investment results cannot be compared to those of the Government Pension Fund Global (GPFG), commonly referred to as the Norwegian oil fund, or market-based occupational pension funds, to mention a few examples. The major

¹⁰⁷Henry Ford is attributed the quote in relation to the Ford Model T: "Any customer can have any color that he wants as long as it is black." This allowed Ford to produce cars with great economies of scale. (It can also be noted that black paint dried the fastest.)

constraint is the guaranteed pension that ATP must deliver on parts of the contributions. ATP is also required by law to deliver a lifelong pension. Both requirements generate value to the overall pension system, but they also impose restrictions on ATP's investment strategy. In the subsequent sections, our basic premise is that ATP should exercise its comparative advantages. Our guiding principle is that ATP, within its constraints and with due regard to the overall pension system, should deliver the best possible pension. In practice, that assessment will be made by looking at components of ATP's investment strategy. However, before we address these, there are several more fundamental questions that need to be considered.

10.3 The inflation objective and the overall design of ATP

In addition to the mandate, the Supervisory Board of ATP asked us to pinpoint elements beyond the investment strategy that have significant investment implications for ATP. As stated above, ATP's investment strategy reflects both the constraints imposed by legislation and key decisions by ATP's Supervisory Board. All constraints and decisions have a shadow price. A shadow price is the opportunity cost of the constraint, in other words what could have been achieved in terms of the overall objective had the constraint not been there? As this goes beyond our mandate, we do not make any recommendations.

Two important elements that have implications for the investment strategy are ATP's interpretation of the inflation indexation objective, and that contributions are not indexed to wage inflation. A less ambitious inflation indexation objective combined with contributions indexed to wage inflation could generate the same pensions at a more moderate required return. This would allow the ATP architecture, including the Investment Portfolio, Market Return Portfolio, and Supplementary Hedge Portfolio, to be less ambitiously designed and lower downside risks to the guaranteed pensions (see Section 7.7.6).

The inflation indexation in the ATP Act can be interpreted in different ways. The ATP Act contains two inflation-related objectives: indexation of pensions and indexation of ATP assets. The founders of ATP did not appear to view indexation of pensions as a central objective (see Section 5.4.3). Moreover, the resulting double inflation objective is difficult to justify in theory: ATP must first price expected inflation into the guaranteed pension and then seek additional returns to compensate for realized inflation. The nominal guaranteed pension, the tariffs, already contains a component of expected inflation. In addition, there is an ambition to index the tariffs with realized inflation. The double inflation indexation objective is very ambitious.

ATP has set itself an ambitious inflation indexation objective that drives a complicated design. ATP sees its interpretation as following from the ATP Act (see discussion in Section 5.4).

The inflation indexation objective in the ATP Act deserves clarification by lawmakers. ATP's investment strategy—including its use of leverage, asset mix, risk targets—are partly based on this interpretation.

For a member, higher pension payments could come from two sources: growth in contributions or higher investment returns. Holding the contribution fixed, higher pension payments can only be achieved by taking on higher risk and thereby generating high investment returns. Under the current setup, because contributions are not indexed and the inflation objective for tariffs is pursued only through the Investment Portfolio, the burden falls exclusively on generating high investment returns. This requires an investment excess return of approximately 17 pct that needs to be generated by the Investment Portfolio and the Supplementary Hedge Portfolio, as shown in Section 6.4.1. This is an ambitious return target that requires taking substantial risk and leverage as shown in Section 6.4.2. Holding the investment return fixed, higher pensions can be achieved by growth in contributions (with the caveat that another way of increasing pension benefits would be required for existing pensioners as they are no longer making contributions). This means that for a given desired pension payment, there is a trade-off between increasing expected returns with associated risks for the guaranteed pensions and growth in contributions. The size of contributions falls outside our mandate, but increasing contributions could lower required returns.

The risk-taking in the Investment Portfolio is exemplified by the target given by the Supervisory Board to management to run a 30 pct volatility portfolio. The 30 pct target is a high level of risk for any fund (see Section 6.5.3). For comparison, a 60-40 equity-bond portfolio has a volatility of 9–10 pct. This level of risk-taking is very high for actively managed funds with long-only major market benchmarks. It is comparable to the risk levels of some of the most risk-intensive hedge fund strategies. It is also unusually high measured against the 1-in-200-year solvency benchmark that is standard in the European pension and insurance regulation standards (Solvency II). Even at this high level of risk, the ambitious inflation-indexation objective is not assured: according to ATP's internal Asset Liability Model calculations, the probability of meeting the indexation objective is 59 pct over a 10-year horizon for long-run inflation averaging 2 pct (see Section 7.4.4). In the Solvency II framework, ATP's risk limits correspond to a solvency coverage ratio of around 103 pct—well below other large Danish pension funds. This comparison should be interpreted with some caution, given that ATP's structure differs from ordinary pension funds, but it illustrates that the chosen risk level is high (see Section 4.6).

The investment risk—with a high level of risk exposure and leverage giving rise to reputational risk—is taken in three Risk-seeking Portfolios: Investment Portfolio, Market Return Portfolio, and Supplementary Hedge Portfolio.

The Investment Portfolio corresponds to the Bonus Potential on the liability side. Its risk target is set by the Supervisory Board based on asset liability model analysis and a stated risk appetite. The Investment Portfolio is the main vehicle through which ATP takes discretionary investment risk to meet the inflation indexation.

The Market Return Portfolio gives members direct risk exposure to the market before conversion into Guaranteed Benefits. Introduced as part of the new business model, the Market Return Portfolio is a fully funded portfolio. Gains and losses in the Market Return Portfolio will raise and lower, respectively, future pension payments, but will not endanger the guaranteed obligations.

The Supplementary Hedge Portfolio is the most distinctive part of ATP's risk-seeking architecture and is intended to generate additional returns from the value released by using a higher discount rate. The higher discount rate is justified by the fact that ATP's liabilities are illiquid. Therefore, they should be discounted with a rate that is higher due to the inclusion of an illiquidity spread. The Supplementary Hedge Portfolio was introduced partly to provide additional risk-bearing capacity. It is designed so that gains and losses are absorbed by buffers and only flow into the Investment Portfolio once they exceed certain thresholds, and therefore the Investment Portfolio covers part of the risk in the Supplementary Hedge Portfolio's risk. The idea behind the Supplementary Hedge Portfolio is that, if ATP can stay the course, temporary losses will be reversed and, over the long run, the higher expected return on risky and illiquid assets will be rewarded for bearing short-term volatility. This is different from the Investment Portfolio where ATP will reduce absolute risk after losses.

The Market Return Portfolio and the Supplementary Hedge Portfolio have increased risk-taking at ATP. When the portfolios were introduced as part of the new business model, ATP did not lower the level of risk in the Investment Portfolio. The risk in the Investment Portfolio was held constant even though the introduction of the Market Return Portfolio and the Supplementary Hedge Portfolio reduced the required return ATP needed to generate to support the inflation-indexation objective. The high level of risk-taking in the Investment Portfolio has exposed ATP and its Supervisory Board to reputational risk, as the experience of recent years has shown. The Supplementary Hedge Portfolio not only increases risk-taking but also adds complexity through its buffer feature.

Risk-taking in the Investment Portfolio raises the question of what the risk should be managed against. There are two starting points: the Bonus Potential or the total balance sheet. ATP has no equity, but the Bonus Potential in some ways works as equity. Assessments that characterize ATP as taking high risk relative to the Bonus Potential take this perspective. On the other hand, when measuring the risk relative to ATP's entire balance sheet, the level of risk-taking is low

to moderate. In addition, ATP's unencumbered cash has remained above 10 pct of the balance sheet throughout the evaluation period (see Section 7.5.3), providing the operational liquidity to support the derivative-implemented leverage without forced asset sales.

ATP's risk-taking should be assessed relative to the Bonus Potential when it comes to possible losses and relative to ATP's balance sheet in relation to leverage. The guaranteed liabilities are ultimately what ATP has promised its members. Losses are absorbed by the Bonus Potential and should affect guaranteed liabilities only in extreme circumstances, such as those defined in the Solvency II framework. ATP should aim to maintain a positive Bonus Potential and thereby honor its guarantees. ATP is designed as a guaranteed product, and this guarantee is one of its core contributions to the Danish pension system. If ATP were instead a market-based product, like many occupational pensions today, it would lose a large part of its "raison d'être." Therefore, ATP's risk-taking should be assessed relative to the Bonus Potential. ATP's balance sheet ultimately determines the possible leverage and is therefore relevant relative to leverage. If ATP was a market-based product, risks should be assessed against its balance sheet.

Because ATP's risk capacity is constrained by the Bonus Potential rather than the full balance sheet, its returns cannot be meaningfully compared to funds with larger risk-bearing capacity, such as sovereign wealth funds or market-based occupational pensions. A fund that can use its entire balance sheet to take risk is far less constrained than ATP. ATP can only take risks that expose approximately 1/6 of its balance sheet, whereas a market-based fund can use its entire balance sheet.

10.4 Recommendations

10.4.1 ATP's investment beliefs

ATP's investment philosophy integrates key elements of modern portfolio theory, empirical evidence, and the practice of large investors. Most importantly, ATP starts from its pension promise, which leads to the separation of the Interest Rate Hedge Portfolio, which is designed to support the nominal guarantees, and the Risk-seeking Portfolios, which are designed to generate returns that can support bonus payments and indexation (see Sections 4.1 and 5.5). The core financial beliefs are based on principles that are well-supported in the academic literature (see Section 4.4). These are: risk is the first-order decision, diversification is the only free lunch, compensated risk comes from a limited number of factors, strategic asset allocation matters more than tactical asset allocation, and markets are on average "efficiently inefficient." These beliefs also fit ATP's product design: non-withdrawable contributions, long-dated liabilities, and a large Interest Rate Hedge Portfolio all give ATP comparative advantages in long-horizon investing, derivatives implementation, and low-cost use of leverage. We agree with this core

philosophy.

Our reservation is ATP's investment beliefs in private-market investments. Theoretically, illiquid assets can provide access to sources of returns that are not available in public markets, and ATP's long horizon means that it can bear some illiquidity risk. However, the academic evidence does not support any presumption that private-market investments reliably outperform public markets after fees and adjusting for risk (see Section 4.3.4), and ATP's own track record on illiquid investments is mixed, especially in more recent years (see Section 7.6.5). We endorse ATP's use of public market equivalents for assessing illiquid investments as it highlights how much value is being added in exchange for multi-year lockups, valuation uncertainty, fee complexity, concentration risk, and rebalancing constraints. Illiquidity and complexity are not, in themselves, sources of return; they are sources of risk that should be compensated by higher expected returns. ATP's policy on private markets should highlight its comparative advantages.

ATP's resulting total portfolio looks very different from many institutions. The separation of its Risk-seeking Portfolios from an Interest Rate Hedge Portfolio, use of leverage and using derivatives, and pursuit of diversification by obtaining exposure to a parsimonious number of factors rather than using asset class buckets also causes ATP's portfolio to deviate significantly from market capitalization weighted benchmarks, 60-40 equity-bond portfolios, and most institutional portfolios. This makes resulting performance harder to communicate and exposes ATP to peer risk when conventional benchmarks outperform.

Recommendation 1:

Maintain investment beliefs generally, but reconsider beliefs on illiquid assets

We recommend that ATP generally maintain its investment beliefs; however, ATP could reconsider the purpose of and its comparative advantages in illiquid assets. While peer risk should not be part of the foundation for constructing ATP's portfolio, it needs to be addressed in communications.

10.4.2 ATP's overall investment strategy

ATP maintains a sensible separation of its assets into two main types of portfolios, Risk-seeking Portfolios and an Interest Rate Hedge Portfolio. The Risk-seeking Portfolios consist of the Investment Portfolio, the Market Return Portfolio, and the Supplementary Hedge Portfolio. The Interest Rate Hedge Portfolio is the largest and matches the guarantees. Having an Interest Rate Hedge Portfolio that matches guaranteed liabilities is consistent with best practice and financial theory (see Section 4.1), as is the separation between assets held to secure guaranteed liabilities and assets held in Risk-seeking Portfolios to generate surplus returns.

The substantial variation of the Interest Rate Hedge Portfolio and ATP's liabilities presents a communication challenge. The market value of the liabilities is especially sensitive to movements in interest rates. The Interest Rate Hedge Portfolio, by design, also moves with changes in interest rates. For example, with increasing interest rates both the value of the liabilities and the Interest Rate Hedge Portfolio will decrease. Hence, performance in the Interest Rate Hedge Portfolio should be evaluated by how well it protects the guaranteed liabilities rather than by its stand-alone returns. This should be consistently reiterated in communications.

Recommendation 2:

Investment strategy should maintain matching assets to liabilities

We recommend that ATP maintain its overall investment strategy of separating the funds according to their purpose: maintaining an Interest Rate Hedge Portfolio that matches its liabilities and Risk-seeking Portfolios. However, ATP should put more effort into communicating the consequences of its investment strategy, including the volatility of the Interest Rate Hedge Portfolio.

10.4.3 Risk-taking and leverage

The Investment Portfolio is managed as a risk parity portfolio. In principle, risk parity delivers the highest expected return for a given level of risk by diversifying across more asset classes and risk premiums than a simple equity-bond portfolio (see Section 4.4.1). This investment strategy is also used by some other international institutional investors (see Section 4.5.2). ATP maintains factor exposures to produce the target volatility and takes leverage to scale the risk parity diversified strategy to that target.

The inflation indexation objective requires a high return. The total risk target is a Supervisory Board decision. The objective—which includes expected inflation and indexing pension payments to realized inflation—requires an excess return of approximately 17 pct to be covered by the Investment Portfolio and the Supplementary Hedge Portfolio as a whole (see Section 6.4.1 and Section 7.7.6). Only 20 pct of contributions flow to the Bonus Potential, but ATP aims to deliver inflation indexation on the full pension promise and not solely on the Bonus Potential. Thus, a relatively small risk-bearing portfolio must generate returns to support indexation of a much larger Guaranteed Benefit roughly four times its size. Tax and investment costs are also included in the 17 pct.

ATP operates with a level of annualized volatility in the Investment Portfolio of 30 pct in addition to the risk in the Supplementary Hedge Portfolio. Neither an unlevered equity-bond portfolio nor an all-equity portfolio comes close to this risk level. A diversified risk parity

portfolio levered approximately 5–6 times can achieve this risk level. An all-equity portfolio levered roughly 2 times, or a 60-40 portfolio levered 3–4 times, can in principle deliver the same risk level, but they have a lower Sharpe ratio than a diversified risk parity strategy. Translated into the Solvency II framework, ATP's risk limits correspond to a pension fund having a solvency coverage ratio of approximately 103 pct. This is well below the level that most pension funds aim for (see Section 4.6). Given ATP's importance in the Danish pension system, a more conservative position than the regulatory floor seems warranted.

ATP should reconsider its risk-taking, if it wants to reduce the risk of not honoring the guaranteed pensions. The objective should be to bring ATP's risk of not being able to honor its guarantees somewhat below the implicit probability of insolvency assumed in the leading pension and insurance standards as reflected in Solvency II. The level of risk should reflect the systemic role of ATP and the solvency ratios of other pension providers with guaranteed products. (We do not recommend that ATP should be subject to Solvency II as this would give rise to difficulties for a fund without explicit capital.) Reducing the risk-taking would have the cost of lowering expected pensions. Pensions can be maintained by lifting contributions, but contributions fall outside our mandate.

Once the total level of risk is set, the case for risk parity is strongest as a method of allocating risk. The risk parity strategy is consistent with ATP's investment beliefs and the comparative advantages arising from its product. That is, diversification is the only free lunch, that compensated risk is represented by a limited number of broad factors, and the most important investment decision is the amount of risk rather than the allocation of capital. ATP's risk parity strategy is enabled by a well-functioning treasury capability, allowing it to use leverage and derivatives efficiently within the liquidity available, and takes advantage of the product's non-withdrawable contributions and long-dated liabilities.

Risk parity strategies are consistent with the economic theory of portfolio choice under two important conditions (Section 4.5.2): a low risk-free rate and a sufficiently low stock-bond correlation. The low risk-free rate allows an investor to employ leverage to scale a diversified portfolio to a desired target risk level, and the low or negative stock-bond correlation makes the portfolio diversified with a risk/reward ratio sufficiently high to justify leveraging in the first place. Historically, risk parity has outperformed a 60-40 equity-bond portfolio in eight out of ten 10-year periods (see Section 6.3.4).

Both conditions were violated in 2022 when interest rates rose sharply as central banks raised policy rates to combat inflation and stocks and bonds both fell together. Bonds experienced the worst returns in a century (see Section 7.2.1). Because risk parity holds more fixed income exposure relative to a 60-40 portfolio, and because it uses leverage to scale diversified risk, risk

parity is vulnerable to periods when bonds do not diversify equities. ATP stayed the course and maintained its risk targets, consistent with its investment beliefs and long-run comparative advantage and did not abandon its risk parity framework. The 2022 experience does not invalidate ATP's risk parity strategy, but it does show the need to monitor macro developments, including inflation risks, as these influence correlations. A portfolio may be well diversified in terms of risk, but the expected returns on its risks can be temporarily low (see also Recommendation 7).

Because many pension funds do not run risk parity at the total portfolio level, ATP also bears peer risk. Even when risk parity outperforms over the long run, risk parity returns can diverge significantly from other institutions in the short- and medium-term. ATP should report performance against both risk parity and simple 60-40-style benchmarks, stress the strategy under adverse stock-bond correlation regimes, and communicate clearly that peer underperformance can occur for extended periods (see also Recommendation 8).

Recommendation 3:

Maintain risk-parity strategy, but reconsider level of risk in the Investment Portfolio

We recommend that ATP maintain its risk parity strategy for the Investment Portfolio but reconsider the total level of risk in the Investment Portfolio. The concern is not the leverage itself, which is competently implemented by ATP's treasury operations, but the absolute level of risk which is high relative to other pension funds of similar systemic importance.

10.4.4 Market Return Portfolio and Supplementary Hedge Portfolio

The Market Return Portfolio is a simple way for ATP to introduce market exposure for its members. The Market Return Portfolio invests in risky assets. It supports the annuity with market exposure and is the perfect hedge of the reserve related to the annuity on the liability side. It introduced risky assets to ATP's members without jeopardizing the guarantees. We believe this is an advantage for the members, especially those members that otherwise do not receive market exposure in the pension system or in private savings.

The Supplementary Hedge Portfolio is a complex way for ATP to generate a surplus on top of the guarantees. The Supplementary Hedge Portfolio is an overlay portfolio as it does not have its own funding base, apart from the accumulated undistributed surplus, and uses the loss absorbing capacity available due to illiquidity in the guarantees. The capital allocated to the Supplementary Hedge Portfolio comes from discounting ATP's guaranteed liabilities by a risk-free rate that is not reduced by an illiquidity spread (see Section 5.5.3). The illiquidity spread is

unobservable, but ATP uses a conservative estimate that limits the risks that the allocated capital must be reduced. Furthermore, there are buffers in the m Supplementary Hedge Portfolio that limit the impact of the return, both losses and gains, that must be transferred to the Investment Portfolio. In the normal course of business, ATP must de-risk and sell risky assets during market downturns to protect the guaranteed liabilities. The Supplementary Hedge Portfolio mitigates this procyclical behavior, which makes it a better fit for holding illiquid investments.

The Supplementary Hedge Portfolio raises the risk that ATP cannot honor its guarantees.

There is already a risk, due to the high target risk level and use of leverage, that ATP cannot meet its guaranteed liabilities. The probability of negative Bonus Potential is 0.3 pct on a 10-year horizon at the current risk level in the Investment Portfolio without the Supplementary Hedge Portfolio. Including the Supplementary Hedge Portfolio, as in ATP's current strategy, the probability is 0.6 pct over a 10-year horizon. The probabilities assume management action and are therefore lower than what would follow from a Solvency II framework. These percentages should therefore be interpreted with care. The introduction of the Supplementary Hedge Portfolio doubles the risk of ATP not meeting its guarantees. This is non-trivial for a major pension fund like ATP. Some argue that accepting the risk that ATP cannot honor all its guarantees is a small price to pay for higher average returns, and that the needed reductions in guarantees necessary to regain solvency will be limited. However, by putting the guaranteed pensions at risk, ATP affects its role in the pension system.

ATP's ability to stay the course in the Supplementary Hedge Portfolio may be affected by reputational pressure. Should ATP be forced to liquidate its loss-making positions at the worst possible time—when prices are low but expected returns are high—losses may be substantial. This might happen if the Supervisory Board were to become risk averse in these times. It can also happen if the Supervisory Board is replaced because of the losses and a new Supervisory Board seeks to cut the losses of its predecessors. Reducing this risk of liquidation requires that the Supervisory Board be regularly reminded of the risks it has chosen to take and that these risks be communicated clearly to the public.

When the Supplementary Hedge Portfolio was introduced, the risk in the Investment Portfolio was kept constant despite opportunity to lower the risk. The required excess return to meet ATP's double inflation indexation objective is approximately 17 pct for the Investment Portfolio, if the Supplementary Hedge Portfolio was not introduced (see Sections 6.4.1 and 7.7.6). This corresponds to a volatility of 40 pct in the Investment Portfolio. With the addition of the Supplementary Hedge Portfolio, it would be possible to meet the double inflation indexation objective with the same probability at a lower volatility in the Investment Portfolio of 30 pct. However, ATP chose not to decrease the volatility with the intention of improving the likeli-

hood of meeting its inflation objective.

Recommendation 4:

Prioritize risk-taking in the Market Return Portfolio over the Supplementary Hedge Portfolio

We recommend that ATP prioritize the Market Return Portfolio over the Supplementary Hedge Portfolio if the risk-taking level is to be reduced. The Market Return Portfolio is a simple way to enable exposure to risky sources of return for its members without generating risk to the Bonus Potential. ATP should be cognizant of the complexity and risks of the Supplementary Hedge Portfolio, in particular through the buffer element. The Supplementary Hedge Portfolio requires continuous awareness of its risk by the Supervisory Board and communication to the public.

10.4.5 Illiquid investments

Illiquid investments can offer additional diversification and expand the mean-variance frontier and can generate an illiquidity premium. The long-dated liabilities and its size should give ATP a comparative advantage in investing in illiquid markets. Illiquid investments are potentially a good fit for both the Market Return Portfolio and, albeit some caveats also for the Supplementary Hedge Portfolio, given their capacity to hold onto investments over the long term.

Illiquid investments are difficult to assess in practice (Section 4.3.4). Private markets have high fees, are difficult to evaluate, valuations are smoothed, and performance depends heavily on vintage, manager selection, governance rights, and bargaining power. Also, performance measures such as internal rates of return do not measure the returns an investor actually receives in illiquid investments, total value to paid-in capital does not take into account the time period over which returns are generated, and public market equivalents are dependent on the matching equivalent chosen in public markets (see Sections 4.3.4 and 7.6.5). These difficulties necessitate several different performance measures—each with their own strengths and weaknesses.

ATP's experience in private market investing is mixed with poor performance in certain large investments. Overall, ATP's illiquid portfolio has outperformed a 60-40 portfolio on some metrics. Also, many of its illiquid asset investments have outperformed their asset-specific references. For example, the private equity portfolio has outperformed small stocks. However, it has underperformed global equity markets. Even an investor of the size of ATP may not be able to access the best deals and is at a disadvantage in its ability to attract staff with expertise who can negotiate with firms offering private investments. ATP has recently experienced

poor performance in certain large illiquid investments that have had high public visibility. ATP has analyzed the performance and concluded several lessons. ATP invests in private markets both directly through Global Direct Investments and indirectly using funds with Private Equity Partners. The returns received by ATP from Private Equity Partners investments have not experienced the extreme negative returns of Global Direct Investments. Compared to other funds-of-funds, Private Equity Partners is relatively inexpensive and provides diversified exposure to illiquid investments that larger direct investments do not. Historically, most of the private equity exposure has been through Private Equity Partners.

ATP's experience in private market investment also showed that there are rebalancing and concentration risks. Large holdings of illiquid investments constrain an investor's ability to rebalance unless it is willing to take losses from realizing its illiquid investments. During the downturn in 2022, 70 pct of the risk in the Investment Portfolio was due to illiquids. As a result, most of ATP's rebalancing activities at this time had to be done through public market exposures. This created a less well-balanced portfolio. In addition, if the investments in specific private market deals are significant, concentration can result in both poor performance and the risk of negative publicity—as was the case with Northvolt, TDC, and Copenhagen Airport. ATP decided to reduce its illiquid exposure in 2020, but the share of illiquid investments peaked in 2022 because of earlier commitments, the inability to decrease illiquid positions, and the steep decline of liquid assets during the bear market.

ATP needs a more complete framework for both determining the share of illiquid assets in the portfolio and for assessing its comparative advantage in generating outperformance in illiquid assets. The academic literature suggests that large illiquid positions bring significant risks of concentration and the inability to rebalance the broader portfolio (see Section 4.4.4). There is a need to further develop a framework for assessing when ATP can most advantageously bear concentration risk, its comparative advantages in different segments of the illiquid market space, and the best ways to access private markets. We have seen different performance metrics for illiquid investments that give rise to different conclusions. Some of this reflects the imperfect nature of illiquid asset performance metrics (see Section 4.3.4). ATP already has a rigorous approach for matching illiquid investments to equivalent factor exposures in liquid markets, but more work is needed.

The broader measurement framework should be part of ATP's regular communication. Public market equivalents, constructed by matching illiquid investments with equivalent factor mimicking positions, should remain the primary measure of whether illiquid investments have added value relative to liquid alternatives. We recommend that ATP regularly communicates a separate breakdown of its performance in illiquid markets in addition to its performance in

liquid markets to make it clear whether illiquidity, complexity, and fees have been adequately compensated.

Recommendation 5:

Further develop the illiquid investments framework

We recommend that ATP extend its illiquid investments framework to include the share of illiquid assets and articulate its comparative advantage for generating outperformance. ATP's considerations should include both the risk of being exposed to concentration risk in volatile markets, the effects illiquid assets have on its rebalancing policy, and whether it can harvest an illiquidity premium.

10.4.6 Danish equities

ATP has had impressive performance in its portfolio of Danish equities. The return from 2015 to 2025 has been 12.1 pct per year (see Section 7.7.2). The strong contribution to the performance of ATP's Danish equity portfolio is due to two active decisions: first, the overweight of Danish equities compared to the weight of Denmark in the global equity portfolio, and second, superior selection of specific stocks within the Danish market. ATP has demonstrated a comparative advantage due to its knowledge of the Danish market and its engagement with Danish companies.

The Danish equity market shares many of the characteristics of the global equity market but it is a small market. Danish companies operate in global markets. Danish companies are also distributed across sectors. Thus, the investments do not significantly skew the portfolio in terms of country or sector exposure. However, Danish equities are a small portion of global equities, less than one pct. There is recognition that ATP plays a positive role in the Danish capital market. ATP plays a role as an investor in the corporate governance of Danish companies by expressing its views both at general assemblies and at bilateral meetings. ATP is also active in pressing companies to address Environmental, Social, and Governance (ESG) risks. All of this contributes to the development of Danish capital markets.

Nevertheless, ATP's allocation to the Danish stock market is substantially more than the size of the Danish stock market relative to global stock markets. This gives rise to concentration risk. The outperformance of the Danish stock market relative to global stock markets is unlikely to be a permanent feature. The Danish stock market is also less liquid than the global market. Furthermore, it is more difficult politically for ATP to reduce its holdings of Danish stocks during a market downturn than to reduce its holdings of international stocks. Developments during the downturn in 2022 support this assertion (Sections 7.6.5 and 7.7.4). Thus, Danish

stocks share some of the problems of illiquid investments.

Many investors have a home bias, but this is not in itself an argument for the material overweight of the Danish portfolio. A home bias is that investors are more invested in their national market than its relative share would suggest. Globally, investors in most countries have a home bias (Sections 4.6 and 7.7.4). The Swedish and Dutch pension funds are respectively 33 pct and below 5 pct invested in their local stock markets out of their overall stock market investments. Danish investors also have a home bias. A home bias can be justified by better knowledge of national markets and the legal system, among other reasons. However, only continued risk-adjusted outperformance on Danish equity can justify the extent of the home bias that ATP exhibits.

Recommendation 6:

Develop a quantitative framework for Danish equities

We recommend that ATP explicitly state its investment rationale for the size of the position in Danish equities relative to the global portfolio and its superior ability to select stocks within the Danish market. Given the rationale, it should compute the optimal weight in Danish equities and continuously assess whether the Danish allocation generates a return that can justify the deviation from a more global portfolio.

10.4.7 A stronger return-based framework

ATP can complement its strong factor risk exposure and risk management framework with a more deliberate returns-management framework. The risk side of investment management is one of the strengths of ATP. ATP is highly disciplined in adjusting risk exposures to targets (Sections 6.5.1 and 7.5.2), managing leverage and derivatives, and monitoring liquidity (Section 6.6.3). The investment process could be broadened to place greater emphasis on whether those risk exposures are expected to be adequately compensated. An enormous literature in financial economics documents that risk-reward trade-offs vary over time (Section 4.2). A portfolio that is well-balanced from a risk perspective may not be attractive if the expected return for taking those risks has fallen.

ATP can adopt a stronger benchmark culture. ATP should not, however, adopt a single benchmark for the whole portfolio given that ATP comprises multiple sub-portfolios with distinct mandates and different risk-return profiles (with the separation of hedging and risk-seeking portfolios being most important). The Interest Rate Hedge Portfolio should be benchmarked against the time-varying value of liabilities to isolate any active deviations from pure liability matching. The Investment Portfolio could be benchmarked against a diversified risk parity

benchmark at comparable risk, but we recommend choosing a more conventional market capitalization portfolio, such as a 60-40 global equity-bond portfolio potentially scaled to achieve the long-run volatility target set by the Supervisory Board. (These were some of the comparison portfolios that we used to measure the performance of the total portfolio, the sub-portfolios, and the factor-based investment strategies in Sections 7.5 and 7.6.) The Market Return Portfolio and Supplementary Hedge Portfolio should also have benchmarks that reflect their specific objectives and risk budgets.

Benchmarks would help make ATP's active investment choices more transparent and easier to evaluate. First, ideal benchmarks are explicit, transparent, and are investable at scale. Second, the active decisions—taking leverage to achieve a higher target risk and deviating from the market to harvest long-run factor risk premiums—can be separately measured. Performance attribution can also identify the remaining residual active management within the factor sleeves and the value-added from illiquid investments. A credible benchmark culture rests on further design choices. Benchmarks should be set by the Supervisory Board rather than by the investment staff who are evaluated against them. Benchmarks should also be stable but periodically reviewed, say every three to five years. Performance should be evaluated net of all costs, including external management fees, transaction costs, and the financing costs of leverage, so that the benchmark represents what members would have received under the passive alternative.

Benchmarks help in communicating performance. ATP's investment strategy is deliberately different from conventional pension portfolios—and the product of ATP is especially different from market-rate products—and therefore there can be large deviations between ATP's results and other institutions. Clear benchmarks can help explain underperformance due to the cost of maintaining hedging guarantees, from an unfavorable environment for various chosen factors, poor implementation, or from poor active management in excess of factor exposures. Combined with ex-ante education on when and why certain factor positions, active strategies, or illiquid asset sectors are expected to out- or underperform, benchmarks help the Supervisory Board and stakeholders to distinguish between periods when ATP should stay the course and periods when certain aspects of the investment strategy should be reconsidered. A clear benchmark culture also anchors the conversation about acceptable tracking error, deliberate deviations, and acceptable losses.

Developing a stronger benchmark and return culture requires explicit support from the Supervisory Board. A return-management framework should not be interpreted as a constraint on active risk-taking; rather, it should create the conditions for taking active risk deliberately, measuring it properly, and rewarding it when it adds value. This requires time, analytical

resources, data infrastructure, and investment talent. Benchmarks can also provide a rigorous foundation for evaluating and rewarding investment staff for the active value they add in excess of the benchmarks, aligning compensation with value creation for member outcomes. The same benchmarks should be adopted internally and reported in external communications. Benchmarks also require the Supervisory Board to tolerate periods of underperformance when active positions are well justified ex ante and remain consistent with ATP's mandate. In setting permissible deviations from benchmark, the Supervisory Board should consider both the average deviation (tracking error) and set typical ranges of deviations that would be expected under different market conditions. Tracking error should also be determined considering the comparative advantages of ATP. Without that support, benchmarks can become defensive tools that discourage differentiated investment decisions rather than instruments for improving accountability and long-term returns.

Recommendation 7:

Adopt a more return-focused investment framework

We recommend that ATP adopt a more explicit focus on returns. In addition to maintaining target risk exposures, ATP should regularly assess whether each major exposure is expected to earn sufficient return for its risk, liquidity, leverage, and complexity. This assessment should be anchored in transparent benchmarks, with active risk limits set relative to those benchmarks, and there should be a process for periodic review of the benchmarks.

10.4.8 ATP communication

Communication of pension fund performance is inherently difficult. It often ends up in a very simplified comparison of short-term asset returns relative to other pension funds (see Section 9.1). This could make sense if pension funds were pure asset managers. However, they are not. Their purpose is to deliver a pension.

Communication of pension funds should therefore focus on how they fare in delivering on their pension objective. The pension objective is often specific to the pension fund. ATP's objective is primarily to deliver on its guarantees, and secondarily to inflation index the tariffs. This is what ATP's performance measurement should focus on and not the performance of a sub-portfolio or performance relative to other pension funds. When the value of ATP's Interest Rate Hedge Portfolio drops because interest rates increase, the losses can seem immense. However, they reflect similar movements in ATP's liabilities and should not influence ATP's capacity to deliver on its guaranteed pensions.

Pension fund performance cannot be compared without considering the pensions the fund is

supposed to deliver. It is much easier to deliver a high return on assets if that is the only requirement. If the design of the pension product adds restrictions on the investment policies, this must be explicitly stated. It should also be clearly communicated, if possible, how the restrictions affect the expected returns.

Pension fund communication must focus on the long term and be consistent. Pension funds must deliver in the long run. Investment strategies should not be guided by short-term considerations. There is already too much of a tendency of herd behavior among many funds. It is reputationally costly to stick out compared to others, which risks driving short-term behavior rather than optimal long-term behavior. A good example of herd behavior is the increased allocations to equities across many Danish pension funds (Section 4.6.2). It is not enough to have an optimal long-term strategy—one also needs to be consistent in communicating it. This includes exercising up-front transparency, specifically acknowledging that there will be periods of underperformance.

ATP has at times been selective in its communication. When interest rates dropped, the focus was on the gains on the Interest Rate Hedge Portfolio (Section 9.2). The focus was on the Investment Portfolio in some periods when it outperformed. This has not helped when there were losses on both portfolios. ATP needs to stand by its investment strategy and communicate consistently on how it fares against the objective of delivering on its pension objectives.

ATP's reporting on sub-portfolios should be the second layer in the communication and should be made relative to relevant benchmarks. The Interest Rate Hedge Portfolio should be assessed relative to the promised guarantees. The Investment Portfolio should be compared to an appropriate benchmark. The same applies to both the Market Return Portfolio and the Supplementary Hedge Portfolio. More specific strategies should also be assessed relative to benchmarks.

The third layer in communication should be how the various portfolios contribute to the overall results. The purpose is not to focus on one summary number; the reporting of the performance of various parts of the portfolio should be consistent with the accounts. Another aspect of being consistent is reporting on costs, so that the ultimate goal of paying the promised pensions is met in an efficient manner. The fact remains that ATP is a very low-cost provider (Section 7.7.8). This is one of several areas where public perception does not reflect reality.

Communication should also be reflected in the way ATP is managed. There needs to be consistency in what you say you do and what you do. Therefore, the focus of the Supervisory Board of ATP should be on the pensions that ATP delivers. The most important discussion in the Supervisory Board should be on the trade-off between pension levels and the risks to those pensions. This also has the advantage of being a trade-off that most informed members of the

public can relate to. It is the job of the investment strategy to clarify what the trade-off is and to implement it. Subsequent performance evaluations can then give input to the Supervisory Board on how this has been done.

Recommendation 8:

Consistent communication centered on pensions

We recommend that ATP communicate consistently, centering its communication on the pensions it delivers. The management of ATP should be aligned with this communication focusing on the trade-off between pension levels and pension at risk. The secondary level of communication can focus on performance of the investment strategies relative to benchmarks and show how the performance contributes to the ultimate goal of paying pensions. Persistent misunderstandings in public discussion—on costs, on the role of leverage and derivatives, and on the function of the Interest Rate Hedge Portfolio—make it ATP's responsibility to report regularly and proactively so that public debate is anchored on the outcomes ATP is structured to deliver.

Part III

Appendix

Appendix A

Mandate

January 24, 2025

The ATP pension is part of Pillar 1 of the Danish pension system and, according to the ATP Act, must provide a guaranteed and lifelong pension product, which, together with the state pension, constitutes the economic safety net for Danish pensioners.

The role of the ATP pension and the framework for the design of the pension product are established in the ATP Act. The design of the pension product was last changed in 2021, when a broad majority in the Danish Parliament adopted a change in the design of ATP's pension product. Since then, ATP's Supervisory Board and daily management have been working to implement these changes, and by the end of 2024, all significant decisions in this implementation have been made.

It is therefore an appropriate time to conduct an external evaluation of ATP's investment strategy, including the choices made in connection with the new business model. Additionally, it is considered valuable to conduct an external evaluation of ATP's investment approach at appropriate intervals, as is also seen in the management of the Norwegian oil fund (the Government Pension Fund Global (GPFG)).

Therefore, an external Evaluation Group (hereafter the Evaluation Group) is established to evaluate the risk and investment decisions and choices that ATP's Supervisory Board and daily management have made to implement ATP's pension product, including the most significant elements of the overall investment strategy. Within the ATP Act, the Supervisory Board and daily management have made a series of decisions through an investment strategy and a risk policy, including hedging ATP's liabilities, risk levels, asset allocations, and risk management.

The evaluation should be based on the legal and Supervisory Board-established conditions re-

garding the design of the pension product, including the bonus policy. This refers to the overall design of the ATP product, including, for example, the guarantee element and the length of the interest guarantees provided, as these elements are determined considering the overall pension system in Denmark.

Following this, the Evaluation Group is free to evaluate all investment elements and choices made within the legal framework, including assessing the choices made and making any suggestions for changes, which can include substantive changes and suggestions for simplifications and expansions.

In addition to the above evaluation, the Evaluation Group is requested to provide a perspective on the performance for past results, as well as to assess how the performance can best be put into perspective going forward.

Furthermore, the Evaluation Group is requested to make suggestions for a future communication focus, including supplementary key figures for the ongoing value creation in ATP's pension product. ATP's pension product is a guaranteed and lifelong pension, and the purpose is thus inherently long-term value creation. The design of the product means that the main value creation in the product—the return on the guarantees provided—is not reflected in the financial statements, where the focus in communication typically only becomes the result of the Investment Portfolio, which constitutes a smaller part of the total assets and only contributes to part of the overall value creation. Following this, the Evaluation Group is requested to make suggestions on how the overall value creation of the ATP product can be illustrated and communicated in the ongoing financial statements, possibly using new key figures or similar. The Evaluation Group should consist of a chairman and 2–3 other members, who should be independent Danish and international experts with in-depth knowledge of pensions and investments. The majority of the members should be international experts.

The Evaluation Group's reporting should be done to ATP as soon as possible, but no later than June 2026. The main conclusions from the evaluation will be published, and the chairman of the Evaluation Group will be available to relevant media at the announcement of the evaluation as well as at the presentation of the results.

Appendix B

Author biographies

Andrew Ang

Co-founder of Tau Balance and Adjunct Professor at Columbia University

Andrew Ang is a financial economist specialising in quantitative investing. He is currently an Adjunct Professor at the Columbia School of International and Public Affairs (SIPA). Previously, he was a full-time professor at Columbia Business School and Managing Director and Head of Factors, Sustainable and Solutions at BlackRock. Andrew Ang has published more than 100 publications on topics such as agentic AI investing, sustainable investing, equities, bonds, optimal asset allocation, and alternative investments.

Jesper Berg

Former CEO, Senior Advisor at Rud Pedersen

Jesper Berg has been the chair of the committee evaluating ATP's investment strategy. He was head of the Danish Financial Supervisory Authority from 2015-2023. Before that, he was a bank director at Nykredit Bank, head of first the Market Operations Department and then financial stability at Danmarks Nationalbank, Head of division in the ECB's Monetary Policy Directorate, head of payment services at the Nationalbank, and economist at the IMF. He is currently associated with Rud Pedersen as Senior Advisor, senior fellow at the think tank Bruegel, senior fellow at the CIP Foundation, external lecturer at both the University of Copenhagen and CBS, consultant for the IMF, and chairman of the board of Maj Bank, and member of a number of other boards. Jesper is educated as MSc in Economics (cand.polit., University of Copenhagen) and has an MBA from IMD.

Magnus Dahlquist *Professor of Finance at Stockholm School of Economics*

Magnus Dahlquist is the Handelsbanken Professor of Finance at the Stockholm School of Economics. His research and teaching focus on asset management, asset pricing, and international finance. His current research examines institutions' capital market assumptions, the design of pension plans, and trading strategies in bond and foreign exchange markets. Dahlquist has advised several financial institutions and public authorities, including the Swedish Pensions Agency and the Swedish central bank. Currently, he is a member of a new expert council advising the Norwegian Ministry of Finance on the Norwegian sovereign wealth fund.

Appendix C

Legislation, governance, and supervision

ATP's legal framework both enables and constrains its investment strategy. In this section, we provide more detail on the legislative, governance, and supervisory framework for ATP, which complements the discussion of ATP's architecture in Chapter 5 and the investment implementation in Chapter 6. The section is organized around three questions. First, what is ATP's statutory and supervisory perimeter? Second, how does the ATP Act constrain the pension product? Third, which decisions are reserved to the ATP Act, the Board of Representatives, the Supervisory Board, and daily management?

C.1 Legislative framework

ATP is an independent self-governing institution, established in 1964 under the "Consolidated Act on the Danish Labor Market Supplementary Pension Scheme" (the "ATP Act"), the aim of which is to administer the ATP pension scheme. The ATP Act is within The Danish Ministry of Employment's area of responsibility. The ATP Act outlines the overall governance and purpose of ATP as well as the structure of the ATP product. The ATP Act is organized around 12 chapters which, broadly speaking, cover three areas:

- *Members and the pension product:* These chapters define ATP's members, their rights and obligations towards ATP and the design of ATP Lifelong Pension. There is also a description of the aim of ensuring the real value of pensions through a long-term bonus policy as well as the "Pensions and Provisions Basis," which includes specifications on the calculation of pensions and provisions.

- **Administration and governance:** This part describes internal administrative matters and the corporate governance setup of ATP. The latter defines that ATP shall be managed by a Board of Representatives, a Supervisory Board and a chief executive officer and their roles and responsibilities are described further.
- **Supervision and regulation:** This part of the ATP Act describes the overall setup of ATP with respect to financial supervision and regulation. ATP is under supervision of The Danish Financial Supervisory Authority, which reports to the Ministry of Employment. The ATP Act also states that ATP's assets and liabilities shall be measured at fair value and that ATP shall invest its funds in a manner which serves the members' best interests.

Many of the considerations in the ATP Act are further expounded in a series of executive orders. For example, the tariff is updated each year through the "tariff executive order," and ATP's approach to publishing accounts is specified in the "executive order on accounting."

From a supervisory standpoint, ATP belongs to the Ministry of Employment but is supervised by the Danish Financial Supervisory Authority (DFSA) for matters relating to pension and investment activities. Other Danish pension funds fall under the Ministry of Industry, Business and Financial Affairs. Final supervisory authority for ATP rests with the Ministry of Employment, and ultimately with the Danish Parliament. ATP must report its pensions basis to the DFSA, including interest-rate assumptions, the basis for calculating pensions, the split between guarantee and bonus contributions, and the rules for distributing realized results to members and other beneficiaries. The pensions basis must be both reassuring and fair. The provisions basis associated with ATP's pension commitments must also be reported to the DFSA, which has objection rights.

Although the Danish Insurance Business Act does not apply directly to ATP, the ATP Act incorporates the relevant elements of that framework together with ATP-specific requirements. These include the requirement that ATP be "fair" to members, although this is less stringent than the contribution principle applied in the wider Danish pension industry and therefore permits ATP to operate as a collective scheme, as described in Section 5.2. They also include requirements that the pensions basis be based on satisfactory assumptions and that provisions be sufficient for ATP to meet its pension obligations; restrictions on investment strategy, including limits on allocations to certain asset classes; fiduciary obligations requiring ATP to invest in members' interests and with sufficient security that obligations can be met; and accounting rules for the annual report, which are specified in a dedicated executive order.

Although ATP is not covered by Solvency II, many Solvency II-style risk-management principles have been adopted through ATP-specific regulation, including the executive order on lead-

ership and other subsidiary rules. ATP must maintain an effective system of governance, control, and risk management; observe the prudent-person principle; and ensure fit-and-proper management. It must also maintain key functions for actuarial work, risk management, compliance, and internal audit, and identify, prevent, and manage conflicts of interest through segregation of duties or documented mitigating measures. ATP's governance and risk-management system is documented in strategies, policies, procedures, decision-making processes, and reporting lines, and must support the effective identification, measurement, monitoring, management, and reporting of material risks. ATP also performs an Own Risk and Solvency Assessment (ORSA), including stress tests, quantitative and qualitative risk analysis, and an assessment of the risk-management system. It reports Solvency and Financial Condition Reports (SFCR), Regular Supervisory Reports (RSR), and Quantitative Reporting Templates (QRT) to the DFSA, together with established reporting on risks and key functions. ATP is not required to calculate and report a Solvency Capital Requirement (SCR), although it calculates a simplified SCR for benchmarking purposes.

The ATP Act creates an arm's-length relationship between Parliament and ATP's day-to-day management. Parliament sets the statutory framework and must approve major product changes, while ATP's governing bodies set tariffs, risk limits, investment policies, and implementation choices within that framework. This distinction matters for the evaluation because some features of ATP's investment strategy are management choices, while others follow from the statutory product and the supervisory framework around it.

Some changes in the ATP Act reflect regulatory changes for other pension funds, such as Solvency II, whereas other changes have been made more with focus on changing the ATP product. The most recent and important change was in 2021 when the "new business model" was introduced which led to an update to the executive order on accounting where the balance sheet structure was changed to establish the Long-term Supplementary Reserve and the Risk adjustment. Before this, a notable change occurred with the launch of the new scheme in 2002, which coincided with the introduction of the requirement for ATP to be "fair." The principle of fairness in ATP is inspired by the same principle as for the rest of the pension sector (the contribution principle), but since ATP also strives to index the benefits with inflation, ATP is not subject to the contribution principle per se. At the same time of the adoption of the fairness principle, a modern, age-dependent tariff was introduced. However, setting a tariff based on a market-derived interest rate curve did not occur until 2008.

ATP is obliged to use mark-to-market valuation, which was introduced in 2002. Assets and liabilities must be measured at daily values unless the DFSA decides otherwise; where an asset or liability does not trade in a well-functioning market, ATP must use a recognized approach to

calculate daily values. Mark-to-market should be used as far as possible in the Annual Report.

C.2 Product constraints under the ATP Act

The overall characteristics of the ATP product are defined by the ATP Act while some of the key features of the ATP product, and the investment strategy are set by ATP's Board of Representatives or the Supervisory Board. The ATP Act functions as the legal foundation for the relationship between ATP and its members. ATP does not issue individual contracts in the way that other pension companies and insurers generally do. The Act defines who the members are, the type and size of their contributions, and the benefits they receive. This makes ATP more constrained in product design than ordinary pension providers: launching a new product design requires an amendment to the Act and therefore a full parliamentary process.

The ATP Act therefore regulates ATP differently from ordinary pension funds. In some respects, ATP is more constrained: the ATP Act and related executive orders specify how contributions are divided between guarantee and bonus elements, and how the guarantee contribution is converted into nominal pension commitments. The largest component of the contribution purchases nominal Guaranteed Benefits, which then become part of ATP's stock of accrued pension rights. In other respects, ATP is less constrained by ordinary pension regulation: unlike most pension funds, ATP is not required to calculate and hold a Solvency Capital Requirement under the Solvency II framework. This reflects ATP's statutory design and history, including the fact that ATP was established in 1964 without separate sponsor capital.

The ATP Act is in effect a single contract for all members, and contains the specification of the product since the inception of ATP in 1964. Although the older product specifications are no longer offered, they remain on the books and form part of the guaranteed portfolio and result in a large part of the cash flows which are actively hedged today. Alongside the pension benefits described below, the ATP product also includes some death benefits paid to surviving spouses (or spousal equivalents) and surviving children. These benefits are also specified in the ATP Act and have undergone updates over the years. Section 5.5.5 describes how the ATP product has evolved since inception. The current product is described in further detail in Chapter 5.

The current product has some elements that are updated each year, particularly the tariffs (the value of benefits per DKK 100 of guarantee contribution, which depends on market interest rates) and the cost of death benefits. The Ministry of Employment determines the tariffs on the recommendation of the Supervisory Board of ATP. Rather than updating the ATP Act each year, these elements are defined in an executive order. This follows a simpler process than amending the full ATP Act and so is more appropriate for specifications of this type. The executive order

contains details on guarantee and bonus contributions. The executive order also specifies the proportion of the guarantee contributions to be used for purchasing variable annuity benefits, but these proportions are, however, constrained in separate legal documents:

- The maximum proportion of contributions to be used for guarantees is set in the executive order on “the setting of the maximum guarantee contribution and principles for ATP’s annual tariff.”
- The maximum proportion of the guarantee contribution to be used for variable annuities is set in the ATP Act itself.

The ATP Act constrains the range of values that can be used setting the maximum allowable proportion of guarantee contributions and the maximum allowable proportion of the guarantee contributions allocated to the variable annuity product.

C.3 Administration and governance

The “articles of association” component of the ATP Act defines the administrative organization of ATP. It defines the roles of the Board of Representatives, the Supervisory Board and the Chief Executive Officer (CEO). The Board of Representatives is composed of representatives of a range of specified stakeholder organizations, with specific numbers of representatives from each organization. The composition of both Boards is prescribed by the ATP Act, and the CEO is appointed by the Supervisory Board. The members of the Board of Representatives and the Supervisory Board are appointed by the Ministry of Employment upon the recommendation of the social partners. The Chairman and the other members of the Supervisory Board and the Board of Representatives are appointed for three-year terms, the aim being to achieve a balanced composition of men and women on the Boards. The members are eligible for reappointment. No age limit applies.

Role of the Boards

The Board of Representatives comprises 15 employer representatives, 15 employee representatives, and a Chairman appointed by the Supervisory Board; the Chairman may not be affiliated with any employer or employee organization. The work of both Boards is governed, beyond the statutory provisions, by Rules of Procedure that are reviewed annually. The Board of Representatives ordinarily convenes once a year. Its work includes approving the ATP contribution, ATP’s annual report, and pay policy; determining remuneration for members of both Boards; and appointing ATP’s Chairman and auditors. In all other respects, the Supervisory Board has overall responsibility for ATP and typically convenes seven times a year.

The Supervisory Board is composed of members of the Board of Representatives and comprises six employer representatives, six employee representatives, and the Chairman of the Board of Representatives. The Supervisory Board has a number of committees (see Exhibit C.1). Of these, the Executive Committee has the competence to make certain decisions, for example, hiring members of ATP's Group Management.

The Supervisory Board decides the overall objectives and strategies for the management of ATP. The Supervisory Board approves ATP's pension and provision basis and establishes the framework for ATP's investments each year. The Supervisory Board also approves proposed amendments to the Danish ATP Act to serve as the basis for requesting the Danish Government and Parliament to implement these amendments. The Supervisory Board also approves principles for intercompany transactions and makes decisions on the possible outsourcing of significant activities.

The Supervisory Board of ATP identifies and quantifies the most important risks and sets a risk profile, including risk limits. Pursuant to the Danish ATP Act, ATP has no deputy chairman, and ATP staff members are not eligible to serve on the Supervisory Board. The Supervisory Board establishes policies that govern the most important activities and the risks associated with the activities, including the overall risk target of the Risk-seeking Portfolios, the factor exposures, and the investment policies on illiquid assets. The Supervisory Board provides the CEO written instructions on:

- Controllable limits on the risks that the CEO may take on behalf of ATP. The CEO has redelegated the mandate to the Chief Investment Officer (CIO).
- Principles for calculation of the individual risks.
- Rules on transactions where the CEO requires approval by the Supervisory Board.
- Rules on the reporting to the Supervisory Board on the use of limits and legal restrictions on risks.

The Supervisory Board continuously assesses if the risk profile, the policies and the instructions are in line with ATP's activities, organization, and resources, including capital and liquidity, as well as market conditions. The ATP Act also sets requirements in relation to internal governance, including internal procedures and organization.

The size of the annual contribution is set by the Supervisory Board. The annual contribution is the contribution to be paid by a member employed full time by the same employer. Any decision to this effect shall be approved by a simple majority of votes of the Board of Representatives, subject to the proviso that both a majority of employer representatives and a majority

of employee representatives shall vote in favor of the decision. While the annual tariff rates; is formally set by the Supervisory Board, it is also influenced by the collective bargaining agreements which determine the size of the contributions to the occupational pensions in Pillar 2.

Supervisory Board committees

ATP's Supervisory Board has appointed four committees: an Executive Committee, a Remuneration Committee, an Audit Committee, and a Risk Committee. Their main characteristics are summarized in Exhibit C.1.

Exhibit C.1: Overview of Supervisory Board Committees at ATP. The table shows the main characteristics of the four Supervisory Board Committees at ATP. The Executive Committee performs the duties of the Remuneration Committee.

Name	Members	Composition	Chairman
Executive Committee	3	Chairman from Supervisory Board. One from Supervisory Board appointed by employers. One from Supervisory Board appointed by employees. Remuneration Committee (integrated with Executive Committee).	Same as Supervisory Board
Audit Committee	4	Three members from Executive Committee. One from Supervisory Board with accounting or audit qualifications.	One from Supervisory Board with accounting or audit qualifications.
Risk Committee	4	Chairman from Supervisory Board. Three qualified Supervisory Board members.	Same as Supervisory Board.

The Executive Committee consists of the Chairman and two Supervisory Board members appointed by the employer and employee representatives. Under the Rules of Procedure, it makes certain decisions, such as hiring members of ATP's Group Management, and prepares Supervisory Board resolutions not handled exclusively by the Audit Committee or Risk Committee. It also performs the duties of the Remuneration Committee, whose primary role is to prepare Supervisory Board decisions on remuneration, including pay policy and guidelines for incentive programs. The duties are integrated in the agendas of the Executive Committee on an ongoing basis and comply with the processes applicable for the Executive Committee. The Supervisory

Board specifies the rules of procedure of the Executive Committee.

The purpose of the Audit Committee is to prepare the Supervisory Board's work related to monitoring and controlling matters relating to accounting and auditing, and matters relating to internal control and risk management principles for ATP. ATP's Audit Committee comprises four members: the Chairman of ATP's Supervisory Board, two other members of the Executive Committee and a member of the Supervisory Board with accounting or audit experience, who also serves as Chairman of the committee. The Audit Committee's Terms of Reference are determined by the Supervisory Board.

The purpose of the Risk Committee is to prepare the Supervisory Board's work on risk management, investment strategy and assessment of its own risk and solvency situation, and to discuss relevant topics related to the risk management system. The Risk Committee consists of four Supervisory Board members with the necessary knowledge, qualifications and skills to understand and monitor ATP's risks, including the Chairman of the Supervisory Board who chairs the committee. The Risk Committee's Terms of Reference are determined by the Supervisory Board.

Supervisory Board versus daily management decisions

Decisions regarding ATP's pension product, investment strategy, and implementation sit at three levels: the ATP Act, ATP's Supervisory Board, and daily management. Exhibit [C.2](#) summarizes the main allocation of decision rights.

Review of ATP's Investment Strategy

Exhibit C.2: Overview of decision governance at ATP The table shows important decisions regarding the ATP product, and ATP's investment strategy. The decisions are grouped according to who the main decisionmaker is. Checkmarks (✓) show where the given decision formally lies. Squares (□) represents decisions which formally lie at the ATP's Supervisory Board, but where the actual decision is restricted due to formulations in the ATP Act. Circles (○) represents decisions which lie at the ATP Supervisory Board, but where daily management can somewhat deviate due to factor strategies or tactical overlays. Solid circles (●) represents decisions which lie in the daily management, but larger allocation changes would typically require Supervisory Board discussions.

Decision	ATP Act	ATP Supervisory Board	ATP Management
Product objective	✓		
Product design	✓		
Hedging of liabilities	□	✓	
Risk levels (product and portfolio)	□	✓	
Size of the annual contribution		✓	
Asset allocation (allocation to factors)		✓	
Annual decision on tariff rates		✓	
Allocation of bonus		✓	
Overall illiquid allocation and composition limits		✓	
Hedging currency risk		✓	○
Allocation to Danish assets		●	✓
Application of leverage and derivatives		●	✓
Implementation of asset classes (or factors)			✓
Tactical risk allocation			✓
Tactical asset allocation			✓

The overall characteristics of the ATP product are defined by the ATP Act, including ATP's objective, the guarantee, and the ambition to preserve the real value of pensions. Some key features, such as the size of the annual contribution and the tariffs, are set by the Board of Representatives or the Supervisory Board. The size of the annual contribution is formally set by the Supervisory Board but is influenced by the collective bargaining agreements which determine the size of the contributions to the occupational pensions in Pillar 2. Any change to the annual contribution shall be approved by a simple majority of votes of the Board of Representatives.

Tariffs are updated each year depending on, among other things, market interest rates. The Ministry of Employment determines the tariffs on the recommendation of ATP's Supervisory Board. In practice, the tariffs are decided by ATP's Supervisory Board.

Key investment-strategy decisions reside with the Supervisory Board. ATP's investment strat-

egy is presented to the Supervisory Board on an annual basis and the highest-level strategic decisions include the hedging of the liabilities and the size of the risk levels in the Risk-seeking Portfolios, like the 40 pct risk level in the Investment Portfolio and the 16 pct risk level in the Market Return Portfolio. While these decisions formally lie at the Supervisory Board, the actual decisions are partly constrained by the ATP Act. For example, protecting the guaranteed pensions requires some amount of liability hedging and aiming for the preservation of the real value of pensions requires taking a high level of risk in the Investment Portfolio. The Supervisory Board also determines central elements of asset allocation, including the risk split between liquid and illiquid factors, the size of the illiquid portfolio, currency hedging, and the annual bonus decision.

Some investment decisions reach the Supervisory Board even when the formal decision lies with daily management, either because they are significant, such as single illiquid investments, or because they have other special features, such as allocations to Danish equities. Daily management is responsible for more granular strategic choices and implementation, including exposure to Danish assets and the use of leverage and derivatives, although larger changes would typically require discussion with the Supervisory Board. Implementation of asset classes and factors lies with daily management, as do tactical decisions on risk and asset allocation.

Part of ATP's exposure to illiquid assets is handled through ATP Real Estate and ATP Private Equity Partners, two wholly owned subsidiaries that operate separately from ATP. Each has a Supervisory Board composed of senior ATP staff, and ATP's CIO chairs both.

Appendix D

Risk measure ES(99 pct, 3M)

Risk management is an important part of the operation of a pension fund, even more so for ATP, which is a risk-based investor. ATP must manage guaranteed lifelong liabilities while investing the Bonus Potential and other Risk-seeking Portfolios to generate returns. Its risk framework therefore has two roles: to measure risks across the full balance sheet and to guide management actions that keep those risks within Supervisory Board-approved limits.

Risk management comprises measuring risks and active management actions which limit risks. The latter includes the hedging of the liabilities and rebalancing the Investment Portfolio as the Bonus Potential changes. When the Bonus Potential falls, ATP's capacity to bear investment risk declines and the absolute risk level is reduced.

ATP marks its entire balance sheet to market daily and measures risk across the full balance sheet daily. The risk model is used to monitor whether total risk, portfolio risk, and factor exposures remain within the limits set by the Supervisory Board.

The risk model feeds directly into the risk and asset allocation of the liquid and illiquid pools (see Section 6.7). The same risk model is used by the Supervisory Board to assess whether ATP meets its portfolio risk targets and factor targets, and by management to adjust liquid exposures so that those targets are met. The risk target for the illiquid pool is also based on this model, although illiquid exposures cannot be adjusted as quickly as liquid exposures.

D.1 Definition

ATP's main risk measure is Expected Shortfall over a three-month horizon at a 99 pct confidence level, ES(99 pct, 3M). Expected Shortfall is the average loss in the tail of the distribution. In ATP's case, it is the average of the worst 1 pct of three-month losses; if 10,000 non-

overlapping three-month periods were considered, it would be the average loss in the worst 100 outcomes. Formally, the risk measure is:

$$ES(\alpha, T) = -E[X_t | X_T < x_{1-\alpha}] = \frac{1}{1-\alpha} \int_{\alpha}^1 VaR(p, T) dp$$

where $\alpha = 99$ pct is the confidence in the risk measure, $T = 3M$ (months) is the time horizon of the risk measure. $x_{1-\alpha}$ is the $1 - \alpha = 1$ pct percentile of the distribution. The equation tells us that the Expected Shortfall is the same as the average Value-at-Risk, $VaR(\alpha, T)$, at percentiles which are worse or equal than α . It is thus more conservative than Value-at-Risk at the same percentile.

Under normally distributed returns, $ES(99 \text{ pct}, 3M)$ is approximately 1.33 times the annual standard deviation. Exhibit D.1 illustrates the calculation. Starting from an annual return distribution, with standard deviation σ_{1Y} , the three-month standard deviation can be approximated by square-root-t scaling, that is $\sigma_{3M} = \sigma_{1Y} \cdot \sqrt{1/4}$, and the average loss in the worst 1 pct tail can be calculated from this three-month distribution.

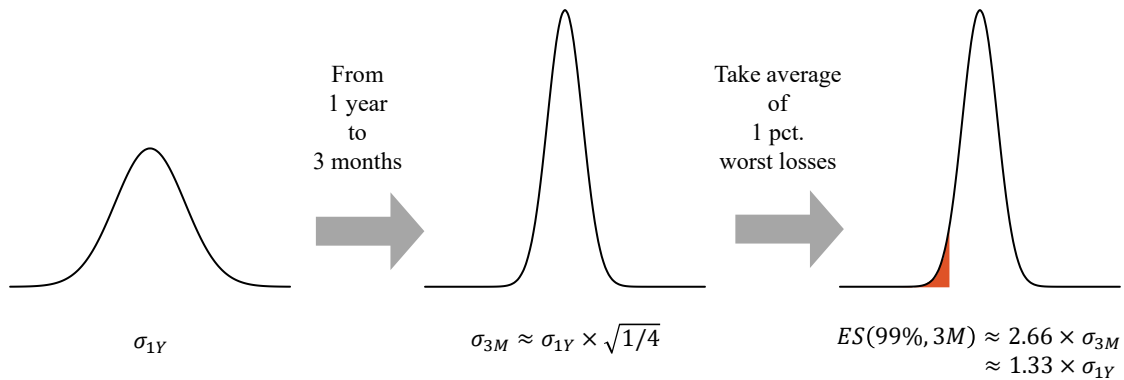


Exhibit D.1: ATP's daily risk Expected Shortfall measure on a 3-month horizon with a 99 pct confidence level. The figure shows how to move from a model specified through an annual standard deviation, to the 3-month distribution and finally how to measure the Expected Shortfall. The scaling at each step is approximate and only holds for independent, identically distributed Gaussian returns.

Mathematically, the Expected Shortfall can be calculated as:

$$ES(\alpha, 3M) = \sigma_{3M} \cdot \frac{\varphi(\Phi^{-1}(\alpha))}{1-\alpha} = \sigma_{1Y} \cdot \sqrt{1/4} \cdot \frac{\varphi(\Phi^{-1}(\alpha))}{1-\alpha}$$

which at a 99 pct confidence level yields:

$$ES(99 \text{ pct}, 3M) = \sigma_{1Y} \cdot \sqrt{1/4} \cdot \frac{\varphi(\Phi^{-1}(0.99))}{1-0.99} \approx 1.33 \cdot \sigma_{1Y}$$

The risk measurement is calculated on a static balance sheet and assumes no management actions. For market risk, ATP applies a zero-pct expected return. The risk measure is therefore conservative as it does not include ATP's ability to reduce risk when the Bonus Potential decreases.

ATP aggregates risk consumption across four main categories: market risk, longevity risk, operational risk, and counterparty risk. For aggregation purposes, market risk is calculated after tax, whereas portfolio risk targets are measured before tax. Each component is modelled separately and then combined using an aggregation matrix, similar to the Solvency II approach:

$$ES(Total) = \sqrt{e' \cdot A \cdot e}$$

where $e = (ES_{Mkt} \quad ES_{Long} \quad ES_{OpRisk} \quad ES_{Cpty})'$ are the risks listed below and A is the aggregation matrix. At present—after substantial analyses, internal and external review— A is set to be an identity matrix. This reflects the low correlations between these risks, such as a low covariation between market and longevity risk within a short time-horizon like three months or a year.

The four risk categories entering this aggregation are measured as follows:

Market risk is the risk from investing in financial markets. ATP models market risk at the security level: public equities are modelled directly from their own price histories, fixed income instruments are priced using simulated yield curves which match the security with relevant government bond or swap curves, and ATP's liabilities are marked-to-market by simulating the underlying yield curves used for liability pricing. As discussed in Section 7.6.5, ATP applies a public market equivalent approach to modelling illiquid assets. That is, the risk department looks at each illiquid investments and computes equity, interest rate, and inflation risk to each individual illiquid investment. In addition, there is an additional risk factor for illiquidity risk. This reduces the effect of smoothing values that are present in accounting valuations of private market investments. From an operational standpoint, market risk modelling is based on simulations from a parametric model supplied from an external vendor which is estimated on data since 2007.

Longevity risk is associated with ATP's members living longer than expected. Because ATP pays lifelong benefits, higher life expectancy increases liability cash flows and must be funded by the Bonus Potential. The longevity risk estimate is based on a simulation of an internally developed longevity model, SAINT, with the mortality model re-estimated in each simulation which reflects how ATP would update its longevity model over time. The longevity risk corresponds roughly to 2 pct of the pension liabilities.

Operational risks is the risk associated with operational events. Operational risk involves losses resulting from inadequate or failed internal processes, people and systems, or from external events. ATP estimates operational risk from its historical operational events and calibrates the model annually to Solvency II. This is conservative, as ATP's actual operational events have had lower frequency and severity than the Solvency II calibration would imply.

Counterparty risk is the loss if a counterparty goes into default. ATP's counterparty risk measures reflects the actual exposures against a given counterparty, distinguishing between different types of exposure, such as cash or derivative exposure, and also takes into account the legal agreements with a given counterparty. Transfer risk and pre-settlement risk are also included.

D.2 Comparison to Solvency II

Although we do not recommend that ATP be under Solvency II, it is useful to compare ATP's risk measure to Solvency II, and it differs from Solvency II in several respects:

- **1-year versus 3-month time horizon:** ATP's risk measure, $ES(99 \text{ pct}, 3M)$ operates on a three-month horizon rather than a 1-year horizon for Solvency II risk measures. With ATP's business model including liability hedging and adjusting CPPI-style risk in the Investment Portfolio, horizons greater than three months likely overstate risk as no management actions are taken into account.
- **Value-at-Risk versus Expected Shortfall:** ATP has chosen Expected Shortfall as it is a coherent risk measure in the sense of [Artzner et al. \(1999\)](#). Value-at-Risk is the risk measure used under Solvency II and other regulatory frameworks.
- **99.5 pct versus 99 pct confidence levels:** At first sight the Solvency II 99.5-percentile seems more conservative than ATP's Expected Shortfall measure which uses a 99-percentile, but in practice due to the difference in risk measures, $VaR(99.5 \text{ pct}, T)$ is approximately 97 pct of the Expected Shortfall at the same time-horizon, $ES(99 \text{ pct}, T)$ under a Gaussian distribution.

Some subtle differences are:

- **Differences in emphasis of the risk measures:** As ATP's risk measures are computed using either external vendors (such as market risks) or internal models (such as longevity), rather than the Solvency II formula, there are different areas of emphasis. A large difference arises for longevity risk, where Solvency II is not fully calibrated to the longevity experience in Denmark over the past decade.

- **Different aggregation coefficients:** ATP uses its own estimates for the aggregation coefficients. The coefficients are evaluated at least annually, and the methodology for estimation is subject to internal and external review.

Under a Gaussian return assumption, the Solvency II one-year VaR measure is approximately twice ATP's three-month Expected Shortfall measure. An approximate ratio between the Expected Shortfall (ES) and Value-at-Risk (VaR) measures can be calculated assuming a Gaussian distribution of returns:

$$\frac{VaR(\beta, S)}{ES(\alpha, T)} = \frac{\sigma\sqrt{S}\Phi^{-1}(\beta)}{\sigma\sqrt{T}\frac{\varphi(\Phi^{-1}(\alpha))}{1-\alpha}} = (1-\alpha)\frac{\Phi^{-1}(\beta)}{\varphi(\Phi^{-1}(\alpha))}\sqrt{\frac{S}{T}}$$

For ATP's risk measure and Solvency II this gives us:

$$\frac{VaR(\beta, S)}{ES(\alpha, T)} = (1-0.99)\frac{\Phi^{-1}(0.995)}{\varphi(\Phi^{-1}(0.99))}\sqrt{\frac{1}{0.25}} \approx 1.93$$

Thus, for a given risk measurement in ATP's risk model, the approximate Solvency II figure would be 1.93 times ATP's risk measurement over a 3-month horizon. This comparison is best understood as an internal model-style comparison rather than a comparison with the Solvency II formula, because ATP's risk measurements are based on ATP-specific estimates rather than fixed regulatory coefficients.

Appendix E

Background on factors

ATP's factor framework is the bridge between the investment theory (Chapter 4) and the architecture of ATP (Chapter 5) to the implemented Risk-seeking Portfolios (Chapter 6). This appendix provides supporting detail behind the factor framework set out in Section 6.3, which defines the four factors, summarizes their historical performance, and compares the factor framework with market-cap-weighted benchmarks. The appendix documents three areas that sit behind that section: how the factors behave across macro-economic states and; how robust ATP's chosen allocation is to changes in the underlying assumptions, including its tracking error relative to more conventional portfolios; and the trade-offs—complexity, leverage and concentration—that shape the allocations in the liquid and illiquid pools.

E.1 Robustness to factor correlations

We provide robustness for the factor allocation framework in Section 6.7.

E.2 Allocation to investment factors in the liquid pool fund

With a well-defined universe of main investment factors, we next turn to the allocation between the factors. The allocation between factors is equivalent to the allocation between asset classes, but constrained by structure that a given factor implementation imposes. This section addresses some considerations on how to allocate to the factors. Where needed historical backtests are also shown, for instance to highlight limitations of the mean-variance model or where actual numbers add to the overall overview. This approach is simplified compared to the actual considerations at ATP, where in addition to simple models and historical backtests, both historical and forward simulated ALM-model analysis is performed. The latter also allows ATP to gauge the impact on the overall balance sheet and the pensions delivered to the

members, such as level of benefits, funding ratios and allocated bonuses (see also [Japhetson and Svenstrup, 2023](#) for some further elaborations).

ATP allocates to factors in a hierarchical manner, that is, the allocation in individual instruments made to have the desired risk-return properties of sub-factors, and the allocation to sub-factors are made to have the desired risk-return properties of the factors, and finally the allocation to factors are made to have the desired risk-return properties of the liquid pool fund as a whole. Deciding on the overall allocation to asset classes would traditionally be based on a mean-variance optimization, which leads to allocations to particular asset class either in an unlevered form (on the efficient frontier) or in a levered form (on the capital allocation line). However, as mentioned in Section 4.5.1, naïve mean-variance optimization suffers from a high sensitivity towards the assumptions made. One method to reduce the dependency of the exact assumptions is the Hierarchical Risk Parity optimization found in [López de Prado \(2016\)](#), which is similar to the cluster analysis in Section 6.3.2. ATP does differ in (at least) one significant element from the Hierarchical Risk Parity approach, since expected returns (or Sharpe ratios) of the factors are taken into consideration when allocating to factors. The allocation approach thus aims at increasing the robustness of allocation, but at a potential cost given that the hierarchical bottom-up approach does not lead to the same allocation as a global (mean-variance) optimization.

Exhibit 6.22 illustrates the hierarchical nature of the portfolio and allocation decisions. At each level, decisions must be made, either on single asset selection, allocation to a particular sub-factor or factor, or at the very top, choosing an appropriate risk level. Even if ATP allocates risk for factor and sub-factors, the allocation to individual asset classes is naturally expressed in a notional allocation as well—the risk model is internal to ATP, but actual trading of positions requires notionals, that is the number of lots to buy of a given futures contract.

Because ATP sets relative weights on gross risk, correlations do not affect how risk is split across factors—they affect only the overall risk level, and hence the leverage needed to reach it. Risk can be allocated in two ways: by gross risk, which ignores the diversification benefit, or by risk contribution, which incorporates it. At every node of its hierarchical structure (see Exhibit 6.22), ATP allocates by gross risk—each component's weight is its share of the summed stand-alone risks—so the correlations between factors, such as the stock–bond correlation, leave the relative weights unchanged. Correlations enter one step later: when components are combined, the actual risk of the aggregate is lower than the weighted sum of its parts' stand-alone risks, and it is this diversified risk that is then scaled up to the chosen risk target. Because more diversification means more scaling, correlations drive the overall risk level and the leverage required to hit the target—but not the relative allocation between subfactors and

factors.

Consider an example. Let $\rho(P_i)$ be the risk for the portfolio P_i . Let S_S be the stocks sub-factor and let S_C be the credit sub-factor, then a factor allocation in the equity factor with weights on stocks given by w_S^S and allocation in credit given by $w_C^S = 1 - w_S^S$ will ensure

$$w_S^S = \frac{\rho(S_S)}{\rho(S_S) + \rho(S_C)}$$

Let F_E be the equity factor, then the (unscaled) risk of the equity factor is given by:

$$\rho(F_E) = \rho(w_S^S \times S_S + w_C^S \times S_C) \leq w_S^S \times \rho(S_S) + w_C^S \times \rho(S_C)$$

Similarly define the remaining factors as F_R , F_I and F_O for the Rates, Inflation and Other factors, respectively. At the portfolio level the allocation to factor i is given by:

$$w_i^F = \frac{\rho(F_i)}{\rho(F_E) + \rho(F_R) + \rho(F_I) + \rho(F_O)}$$

Finally, if the final factor or overall portfolio risk is lower than the risk target, every position in the given subfactor or factor is scaled up to reach the chosen overall risk target. This ensures that the relative risk between elements of hierarchical structure is maintained, while reaching the chosen risk tolerance. Thus, correlations enter into the risk scaling of the overall factor or portfolio, but not the relative allocation between sub-factors or factors.

E.3 Factor allocation with a penalty for complexity

Section 6.7.1 presents results showing that ATP's allocation in the liquid pool corresponds approximately to the unconstrained allocation adjusted for complexity. To compare ATP's allocation to optimized allocations we consider an investor with no constraints and an investor who is penalized for taking on complexity: traditional asset classes are assumed to have zero complexity, and alternative risk premiums are doubly as complex as commodities. In addition to the unconstrained and the complexity penalized allocations, we consider three additional portfolios: ATP's current factor allocation applied to the analysis model, the liquid asset classes in the global market portfolio and the liquid asset classes in the Danish institutional portfolio. All portfolios are leveraged to the risk level of equities. The risk level is 15 pct.

Penalizing complexity brings the optimized portfolio close to ATP's actual allocation, cutting its reliance on alternative risk premiums while leaving expected return essentially unchanged. Exhibit E.1 presents the results of the optimization. Panel (a) reports summary statistics for each portfolio, Panel (b) the risk allocated to each subfactor, and Panel (c) the notional allocations.

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Exhibit E.1: Optimized liquid allocations and comparison portfolios. All portfolios are leveraged to 15 pct volatility. Portfolio statistics report expected return, volatility, Sharpe ratio, and leverage. Subfactor allocation reports risk contributions in volatility terms. Asset allocation reports notional weights in percent.

	Unconstrained portfolio	With complexity penalty	ATP liquid	Global market portfolio (liquid part)	Danish institutional portfolio (liquid part)
Portfolio statistics					
Expected return (pct)	8.5	8.0	8.0	7.2	6.7
Volatility (pct)	15.0	15.0	15.0	15.0	15.0
Sharpe ratio	0.43	0.40	0.40	0.35	0.32
Leverage	2.83×	2.80×	2.65×	1.78×	1.22×
Subfactor allocation (volatility in pct)					
Stocks	7.9	9.1	10.3	13.7	14.5
Credit	1.9	2.1	1.8	0.8	0.6
Rate	6.9	9.6	8.6	4.6	1.0
Output inflation	0.0	2.2	2.1	0.2	0.0
Input inflation	4.6	2.6	2.1	0.0	0.0
Alternative risk premi- ums	6.9	1.9	2.1	0.0	0.2
Diversification	−13.1	−12.6	−11.9	−4.2	−1.2
Asset allocation (in pct)					
Equities	52.3	60.9	68.4	91.2	96.8
Bonds	92.3	91.1	79.8	63.7	8.7
[8Y duration]					
Public credit	46.2	53.4	45.3	19.7	14.7
[4Y duration]					
Inflation linked bonds	0.0	42.5	40.4	3.0	0.0
[8Y duration]					
Commodities	22.9	12.3	10.5	0.0	0.0
Alternative risk premi- ums	69.2	19.0	20.8	0.0	1.6
Funding	−182.9	−180.0	−165.1	−77.5	−21.7

The unconstrained portfolio holds roughly 70 pct in alternative risk premiums—almost as much as in equities. Because these strategies carry more uncertainty and complexity, we also

solve the problem with a cost attached to that complexity; the allocation to alternative risk premiums then falls to about 20 pct, and the inflation factor tilts towards inflation-linked bonds. ATP's actual allocation differs from the complexity-penalized optimum in its details, but—most importantly—the two deliver almost the same expected return.

ATP's liquid portfolio behaves like a complexity-aware optimizer, spreading risk across subfactors similar to the complexity-penalized optimum and more evenly than traditional equity-heavy portfolios, as shown in Exhibit E.2. ATP's subfactor risk profile lines up almost bar-for-bar with the complexity-penalized optimum, and both are far more diversified than the equity-dominated traditional portfolios. Moving from the unconstrained to the complexity-penalized optimum, the large Other factor of alternative risk premium strategies and input-inflation exposures largely disappear and the freed risk budget flows into stocks and the Rates factor. ATP's actual allocation (green) then tracks the complexity-penalized bars (blue) closely across every subfactor—stocks, credit spreads, the Rates factor and the two inflation subfactors—confirming that ATP behaves like an optimizer that prices in complexity. The two traditional portfolios look quite different: the Global Market and Liquid Institutional portfolios load almost all of their risk onto stocks.

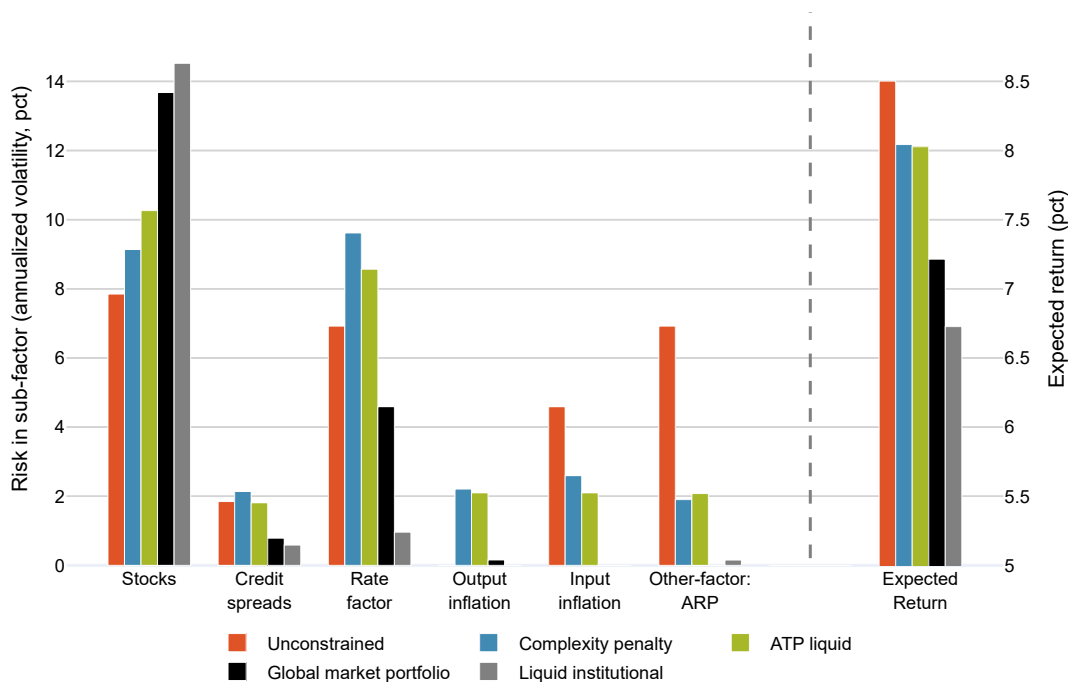


Exhibit E.2: Subfactor allocations for portfolio optimizations.

E.4 Robustness of the chosen factor allocation

We examine robustness of ATP's factor allocation in Section 6.7.1 by changing various assumptions:

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- **Baseline:** Same set of assumptions used in Section [6.7.1](#).
- **Higher rate Sharpe ratio:** The Sharpe ratio on interest rates has the same relative size compared to the equity factor as the historical data, that is, the Sharpe ratio on the Rates factor increases from 0.2 to 0.233.
- **Lower rate Sharpe ratio:** The Sharpe ratio on interest rates falls to 1/3 of the Sharpe ratio of the equity factor, that is, the Sharpe ratio on the Rates factor decreases from 0.2 to 0.1.
- **Higher volatility:** All volatilities increase by 10 pct. For example, the volatility of Equities increases from 15 pct to 16.5 pct.
- **Worse bond-equity correlation:** The correlation between bonds and equities increases from 0 to 0.25.

Two exercises are run: one re-optimizes across the factors, the other holds fixed portfolios constant. The first re-optimizes across ATP's factors under each set of assumptions. The second holds three portfolios fixed—ATP's current allocation, the liquid part of the Global Market Portfolio, and the liquid part of the Institutional Portfolio—and measures the effect of the changed assumptions.

The optimized allocation moves with the rate assumption, and the Inflation factor moves with it because it hedges the Rates factor. Exhibit [E.3](#) reports portfolio metrics for the different approaches and allocations for the optimized allocations.

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Exhibit E.3: Robustness of liquid factor allocations under alternative assumptions. Each column corresponds to a change in capital-market assumptions. The first panel reports re-optimized allocations; the remaining panels hold fixed ATP's current allocation and the liquid parts of the global market and institutional portfolios.

	Baseline	Higher rate Sharpe ratio	Lower rate Sharpe ratio	Higher volatility	Worse bond- equity correlation
Optimized allocations: Relative sub-factor allocation					
Stocks (pct)	34	31	47	33	35
Credit (pct)	6	5	8	6	6
Rate (pct)	35	38	24	35	32
Input inflation (pct)	9	10	6	9	9
Output inflation (pct)	9	10	6	9	9
Other (pct)	7	7	8	8	8
Optimized allocations: Risk and return					
Expected return (pct)	8.0	8.4	7.2	8.1	7.5
Volatility (pct)	15.0	15.0	15.0	15.0	15.0
Sharpe ratio	0.40	0.43	0.35	0.41	0.36
Leverage	2.79×	2.90×	2.27×	2.56×	2.44×
Current allocation: Risk and return					
Expected return (pct)	8.0	8.3	7.2	8.6	8.0
Volatility (pct)	15.0	15.0	15.0	16.5	16.6
Sharpe ratio	0.40	0.42	0.34	0.40	0.36
Leverage	2.65×	2.65×	2.65×	2.65×	2.65×
Liquid part of global market portfolio: Risk and return					
Expected return (pct)	7.2	7.4	6.8	7.7	7.2
Volatility (pct)	15.0	15.0	15.0	16.5	16.1
Sharpe ratio	0.35	0.36	0.32	0.35	0.32
Leverage	1.78×	1.78×	1.78×	1.78×	1.78×
Liquid part of institutional portfolio: Risk and return					
Expected return (pct)	6.7	6.8	6.6	7.2	6.7
Volatility (pct)	15.0	15.0	15.0	16.5	15.2
Sharpe ratio	0.32	0.32	0.31	0.32	0.32
Leverage	1.22×	1.22×	1.22×	1.22×	1.22×

Lower (higher) Sharpe ratios on the Rates factor (obviously) lead to a lower (higher) allocations to the Rates factor. More interestingly, the allocation to the Inflation factor follows suit, because

the Inflation factor partially hedges the Rates factor. ATP's current factor allocation roughly corresponds to a weighted average of the Baseline scenario, the Lower Rate Sharpe ratio and the Worse Bond-Equity Correlation scenarios. This deliberately leans towards scenarios that may not be captured in standard risk models or capital-market assumptions, such as regime changes in term premiums driven by geopolitical risk.

Held fixed, ATP's current allocation earns almost the same risk-adjusted return as the re-optimized portfolios, while a traditional portfolio loses more in every scenario. ATP's allocation balances across scenarios and gives up very little in Sharpe ratio. Under Higher volatility, the optimized portfolio keeps roughly the same relative factor weights but reduces leverage, while a fixed allocation keeps leverage unchanged and runs higher risk. Under the Worse bond-equity correlation scenario, the equity-heavy institutional portfolio sees only a small rise in volatility (15.0 pct to 15.2 pct), whereas ATP's risk-balanced approach is more affected (15.0 pct to 16.6 pct). Anticipating this scenario, ATP would cut rate exposure and reduce leverage from $2.79\times$ to $2.44\times$ the latter driven mainly by the higher portfolio volatility if exposure were left unchanged.

E.5 Tracking error versus traditional portfolios

Because ATP departs from market consensus, it needs to know its tracking error, how well that risk is paid, and over what horizon outperformance is likely. Section 6.3.3 documents large tracking error of the factor approach relative to market-capitalization benchmarks and Section 6.3.4 documents large tracking error of ATP's factor portfolio relative to 60-40 equity-bond benchmarks. In this section, we examine the robustness of the factor allocation based on tracking errors to traditional portfolios. The comparison is made two ways: at a common 15 pct volatility—a like-for-like test of what ATP would have earned had it chosen the traditional portfolios instead—and at ATP's higher investment-portfolio risk level (30 pct volatility) against the unlevered traditional portfolios, which also captures the effect of taking more risk.

The information ratio is positive in every comparison, but a positive information ratio does not spare the portfolio extended stretches of underperformance as shown in Exhibit E.4. At the same risk level, the information ratio is 0.17—a measure of the superior allocation—while across risk levels it is 0.41, which mainly reflects the portfolio's Sharpe ratio as leverage is applied. Over a one-year horizon, risk dominates and the likelihood of outperformance is close to 50-50; even at the same risk level, roughly 3 in 10 ten-year periods would result in underperformance relative to a traditional approach. Taking more investment risk raises the long-run likelihood of outperformance to about 9 in 10 ten-year periods.

Exhibit E.4: Tracking error and outperformance probabilities versus traditional liquid portfolios. The left block compares ATP and the traditional portfolios at a common 15 pct volatility. The right block compares ATP at 30 pct volatility with the unlevered traditional portfolios.

	All portfolios at 15 pct volatility		ATP at 30 pct volatility, other portfolios are unlevered	
	Liquid part of global market portfolio	Liquid part of institutional portfolio	Liquid part of global market portfolio	Liquid part of institutional portfolio
Annual tracking error (pct)	4.8	7.5	22.1	20.1
Information ratio	0.17	0.17	0.41	0.41
1-year probability of ATP outperformance (pct)	56.7	56.9	66.0	65.8
5-year probability of ATP outperformance (pct)	64.7	65.2	82.1	81.8
10-year probability of ATP outperformance (pct)	70.4	70.9	90.3	90.0

E.6 Complexity and leverage in the illiquid pool

Section 6.7.1 describes that concentration limits on ATP's illiquid investments are required because the factor model can produce overly concentrated portfolios. Adding a concentration penalty pushes the portfolio away from a near-real-estate solution toward a more diversified mix of private market assets. Adding a leverage penalty further changes the allocation because private equity, which has relatively high volatility, can achieve the same risk target with less leverage than real estate, which has relatively low volatility.

Penalizing concentration diversifies the portfolio away from real estate, and adding a leverage penalty then tilts it towards private equity, as shown in Exhibit E.5. With a concentration penalty the factor exposure moves towards the equity factor (stocks and credit), both leverage and expected return fall, and the effective number of asset classes rises from 1.1 to over 3. A further leverage penalty favors private equity, which carries the highest stand-alone risk and is therefore the most efficient way to reduce leverage, at a small further cost in expected return.

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Exhibit E.5: Optimized illiquid allocations and comparison portfolios. All portfolios are leveraged to 15 pct volatility. Portfolio statistics report expected return, volatility, Sharpe ratio, leverage, and the effective number of asset classes. Subfactor allocation reports risk contributions in volatility terms. Asset allocation reports notional weights in percent.

	Unconstrained portfolio	With conc. penalty	With conc. & leverage penalty	ATP illiquid	Global market portfolio (illiquid part)	Danish institutional portfolio (illiquid part)
Portfolio statistics						
Expected return (pct)	7.8	7.4	7.3	7.3	7.0	7.0
Volatility (pct)	15.0	15.0	15.0	15.0	15.0	15.0
Sharpe ratio	0.39	0.36	0.35	0.35	0.33	0.33
Leverage	1.59×	1.30×	1.16×	1.21×	0.92×	1.01×
Effective number of asset classes	1.1	3.4	3.2	3.7	1.7	2.8
Subfactor allocation (volatility in pct)						
Stocks	7.0	10.1	11.3	10.7	13.2	12.2
Credit	0.8	1.9	1.3	1.9	0.0	1.2
Rate	12.4	5.6	4.3	4.3	2.3	2.0
Output inflation	6.8	3.3	2.5	2.6	1.3	1.3
Illiquidity	4.8	3.5	3.1	3.2	2.4	2.5
Diversification	−16.8	−9.4	−7.5	−7.5	−4.2	−4.3
Asset allocation (in pct)						
Private equity	1.4	28.9	42.5	36.3	63.9	52.6
Real estate	150.3	54.3	43.4	38.7	27.9	13.3
Infrastructure	0.0	29.7	18.6	28.7	0.0	23.8
Private credit	6.8	17.5	11.3	17.3	0.0	11.1
Funding	−58.6	−30.4	−15.9	−21.1	8.2	−0.7

ATP's actual illiquid portfolio resembles the doubly penalized optimum but carries somewhat

more leverage, reflecting its comparative advantage in funding. Its factor exposure and expected return are close to those of the portfolio penalized for both concentration and leverage, with a slightly different asset mix. This is consistent with ATP being less leverage-averse than the average investor, including in illiquid assets: the Interest Rate Hedge Portfolio and Treasury Portfolio give ATP a comparative advantage in employing leverage—especially after the additional risk introduced in the Supplementary Hedge Portfolio. Compared with the illiquid parts of the Global Market and Institutional portfolios, ATP holds less private equity and more infrastructure and real estate, which raises expected return at a given risk level but requires more leverage. In practice, ATP sets overall and factor risk targets rather than hard asset-class targets, and each investment is judged on how it fits the portfolio and whether it clears both bottom-up (WACC) and factor-based return requirements.

Appendix F

Cost comparisons between ATP, AP Funds, and GPFG

This appendix details the cost reporting method applied by the Swedish AP Funds and the Norwegian Government Pension Fund Global (GPFG), and what ATP's management costs are in direct comparisons. Comparing cost levels across institutions is structurally challenging, as categories may not be defined consistently and can include different underlying components (such as transaction costs).

AP Funds

Each year, the Swedish Pensions Agency publishes the *Orange Report*, which summarizes key cost categories across the AP Funds: *Pension administration*, *Operating costs*, *Management fees for listed assets*, *Performance fees for listed assets*, and *Transaction costs*.

In the 2024 report, total management costs for the AP Funds were stated at 0.07 pct, based on the categories *Operating costs* and *Management fees for listed assets*. Applying the same categories, ATP would have a cost base of 0.09 pct in 2024.

From the individual AP Fund annual reports, it is possible to identify management fees for unlisted assets, although not all fees are disclosed, such as funds-of-funds. In addition, the AP Funds do not report *Performance fees for unlisted assets*. By including the additional disclosed management fees the cost base increases to 0.31 pct for the AP Funds, compared to 0.21 pct for ATP using the same cost categories.

Through dialogue with AP4 it has been clarified that while the AP Funds have allocations to unlisted real estate, costs related to the operation and management of these assets are not

included. We have also observed that reported transaction costs for the AP Funds are significantly lower than those of ATP.

GPFG

GPFG reports a management cost ratio of 0.04 pct for 2024. This figure excludes cost components that are included in ATP's reported total costs, most notably direct transaction costs, which GPFG discloses separately in its annual report. In addition, as a sovereign wealth fund, GPFG does not incur pension administration costs.

Based on dialogue with GPFG, we have confirmed that its "ATP-equivalent" investment costs amount to 0.07 pct.

Using the same cost scope as GPFG's reported 0.04 pct, and excluding direct transaction costs and pension administration costs, ATP's adjusted cost ratio would be approximately 0.27 pct.

GPFG's very low cost ratio is partly attributable to its scale and a high share of listed assets, which typically entail lower management costs.

Part IV

References and glossary

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Glossary

ATP product

Bonus contribution The share of the contribution which is not directly allocated to pension benefits, but instead to allocated to ATP's Bonus Potential. Typically, 20 pct of the total contribution.

Contribution The payments (premiums) that ATP's members make to ATP monthly. The contribution is split into a Bonus contribution and a Guarantee contribution.

Guarantee contribution The share of the contribution which is directly allocated to pension benefits. The share is typically (and maximally) 80 pct of the total contribution. The guarantee contribution is split into an Interest rate contribution and a Market contribution. All pensions related to the guarantee contribution are given a longevity guarantee.

Interest rate contribution The share of the Guarantee contribution which is given an interest rate guarantee. For members with more than 15 years to retirement, the share is typically (and minimally) 75 pct. For members with less than 15 years to retirement, the share is 100 pct.

Life Annuity with Market Exposure (LMM) An ATP pension product, without any interest rate guarantee, where the pension rights follows the return on the Market Return Portfolio. LMM is a life-long pension product with full longevity insurance coverage. This means that not only will any member receive their pension as long as they live, but they are also covered against longevity risk during the savings phase such that any increase in life expectancy will not reduce the annual pension right obtained on already paid in contributions.

Longevity guarantee A guarantee that the pension rights will be paid for as long as the member lives. The longevity guarantee is provided for all pensions related to the Guaranteed

Benefits, and for the Life Annuity with Market Exposure. The Bonus Potential is the ultimate buffer for the longevity guarantee, since it is the only liability item that can absorb changes in life expectancy..

Market contribution The share of the Guarantee contribution which is allocated to the Life Annuity with Market Exposure. For members with more than 15 years to retirement, the share is typically (and maximally) 25 pct. For members with less than 15 years to retirement, the share is 0 pct.

Pension rights Each ATP member's claim to future pension benefits is calculated, measured and recorded as pension rights. They represent an estimate of the future benefit to be paid to the member in the form of either a monthly or annual cashflow. They are calculated as annuities using actuarial methodology with important input parameters such as the tariff and life expectancy of the member. They are not necessarily guaranteed, although the majority of the pension rights at ATP are indeed guaranteed.

Rolling annuity An annuity where the pension rights arising from the tariff are fixed for 15 years and then reset 15 years later, unless the member is close enough to retirement, at which point the rolling annuity is converted into a life-long annuity.

Tariff The interest rate applied to convert any contribution or bonus allocated to a member into future pension rights. For new contributions and bonuses, the tariff will typically be one of three values: The prevailing 15-year zero-coupon risk-free interest rate (for the "rolling-annuity"), the prevailing full risk-free zero-coupon interest rate curve (for the "life-long annuity") or zero (for the "variable annuity"). In the case of the rolling annuity, the pension rights arising from the tariff are fixed for 15 years and then reset 15 years later, unless the member is close enough to retirement, at which point the rolling annuity is converted into a life-long annuity. In the case of the life-long annuity, the pension rights arising from the tariff are fixed for the remainder of the member's life. For the variable annuity, pension rights are adjusted on a monthly basis in accordance with the realized investment return in the Market Return Portfolio and calculated using a tariff rate of zero.

ATP balance sheet

Assets under management (AuM) The market value of all the assets of ATP corresponding to the total wealth of ATP (that is, equivalent to the sum of all liabilities).

Bonus ability A distinct ATP term, whose value is equal to the bonus ratio.

Bonus Potential (BP) The primary collective buffer of ATP, which should be invested to balance the long-term aspiration of indexing pension benefits against the probability of a low funding ratio. The Bonus Potential also covers longevity risks and other costs. The Bonus Potential originates from the Bonus contribution. All profits and losses, that are not subsumed within other liability items will ultimately be borne by the Bonus Potential, which is the ultimate capital buffer of ATP.

Bonus ratio Bonus potential relative to the sum of the value of the pension rights (that is, Guaranteed Benefits measured without an illiquidity spread) and the reserve related to Annuity with market exposure. That is: $\text{Bonus ratio} = \text{BP} / (\text{GY} + \text{H}_m)$.

Collective buffer The Collective buffer is the sum of the liability items which are not yet allocated directly to pension rights. It reflects Bonus contribution and returns generated the Investment Portfolio and the Supplementary Hedge Portfolio: $\text{Collective Buffer} = \text{BP} + \text{SAP surplus}$.

Guaranteed Benefits The cash flows related to allocated ATP pension benefits, as well as rolling annuities, that is, liabilities with interest rate sensitivity. The discounted value when using a discount curve without illiquidity spread is termed GY, whereas the discounted value when applying an illiquidity spread is termed GY^S .

Guaranteed Benefits valued with an illiquidity spread (GY^S) Discounted (market) value of the Guaranteed Benefits, when valued using a discount curve with illiquidity spread. Also see Guaranteed Benefits.

Guaranteed Benefits valued without an illiquidity spread (GY) Discounted (market) value of the Guaranteed Benefits, when valued using a discount curve without illiquidity spread. Also see Guaranteed Benefits.

Illiquidity spread A spread used to discount illiquid cash flows. In the case of ATP, the illiquidity spread is applied to the Guaranteed Benefits to reflect the illiquidity in ATP's liabilities. The illiquidity spread is a consequence of applying IFRS 17. See Section 5.5.3 for further details.

Long-term Supplementary Reserve (LSH) Reserve which measures the illiquidity in ATP's liabilities and related long-term investment returns. It is the difference between the Guaranteed Benefits valued with and without the illiquidity spread, and the accumulated

profit and loss from the Supplementary Hedge Portfolio (SAP). Finally it also takes the Risk Adjustment (RA) into account. Thus, $LSH = GY - GY^S - RA + PnL(SAP)$.

Loss absorbing capacity The loss absorbing capacity is the part of ATP's liability side, which is able to bear losses in the short term. This can be items in the liability side that belongs to the collective, as well as the individual. The only common denominator is that the items are able to absorb a loss in the short term. Thus, Loss absorbing capacity = BP + H_m + LSH.

Pension liabilities Pension Liabilities are the value of all liability items that do not have a loss-absorbing capacity. Pension Liabilities are defined as follows: Pension Liabilities = $GY^S + H_m + RA = AuM - BP - LSH$.

Reserve for the Life Annuity with Market Exposure (H_m) The reserves related to the liabilities associated with the Life Annuity with Market Exposure (LMM), that is, liabilities arising from the Market contribution.

Risk Adjustment (RA) provision for uncertainty regarding non-financial risk. The risk adjustment is a consequence of applying IFRS 17.

Risk-seeking Portfolios' own funding The Risk-seeking Portfolios' own funding is per construction equal to the unguaranteed funds, since they constitute the own funding base of the Risk-seeking Portfolios. It is hence equal to the net market value of the Risk-seeking Portfolios. In other words, it is the part of the gross market value of the Risk-seeking Portfolios, which is not funded via a loan from the Treasury Portfolio.

SAP surplus SAP surplus is the accumulated investment profit and loss on Supplementary Hedge Portfolio (SAP) subtracted by the accumulated transfers from LSH to BP. The transfers from LSH to BP can be both positive and negative.

Tax asset A negative investment return generates a negative tax position. Rather than receiving a cash refund from the Danish state, ATP obtains the right to offset the tax loss against future taxable investment returns. This tax asset is carried forward indefinitely and is realized only once ATP generates sufficient taxable returns. This contrasts with the remainder of the Danish pensions sector, where the claim is fully reimbursed in cash after 5 years. Currently ATP's tax asset is more than DKK 40 billion, mainly stemming from the losses in 2022 on the Interest Rate Hedge Portfolio.

Unguaranteed funds The Unguaranteed funds are the parts of the liability side, which are able to fully absorb investment losses in both the short term and the long term. They are defined as follows: $\text{Unguaranteed funds} = \text{AuM} - \text{GY} = \text{SAP Surplus} + \text{Hm} + \text{BP}$. They also constitute the Risk-seeking Portfolios' own funding base.

Value of the pension rights The value of all individualized pension rights. It is the sum of the Guaranteed Benefits values without an illiquidity spread and the reserve for the Life Annuity with Market Exposure, that is $\text{Value of pension rights} = \text{GY} + \text{H}_m$.

ATP portfolios and factors

Equity factor The Equity factor represents exposure to equity-type risk. The Equity factor has two sub-factors: the Stock sub-factor and the Credit sub-factor. The Stock sub-factor is related to variation in stock prices, and is represented by broad market equity indices. The Credit sub-factor is related to changes in credit spread and is represented by credit default swaps. See Section 6.3 for further details.

Hedging business area The hedging business area is comprised of all the means on the asset side, which stems from portfolios that corresponds to liability items relating to the pension rights. There is one exception: the SAP surplus is part of the hedging business area, since the means residing as SAP surplus belongs to SAP, which is a portfolio dedicated to the pension rights. When means from SAP surplus are transferred from LSH to the Bonus Potential, they will disappear from the hedging business area and enter the investment business area.

Inflation factor The Inflation factor represents exposure to inflation-type risk. The Inflation factor has two sub-factors: the input-inflation sub-factor and the output-inflation sub-factor. The input-inflation sub-factor is related to variation in commodity prices, and is represented by broad basket of commodity futures. The output-inflation sub-factor is related to changes in break-even inflation and is represented by inflations swaps. See Section 6.3 for further details.

Interest Rate Hedge Portfolio (AFD) Portfolio which hedges the interest rate sensitivity in ATP's liabilities. The portfolio hedges the interest rate sensitivity of Guaranteed Benefits without an illiquidity spread (GY). See Section 6.2 for further details.

Investment business area The investment business area is comprised of the means on the asset side, which stems from portfolios that corresponds to liability items not related to the

pension rights. There is one exception: the SAP surplus is part of the Hedging business area, since the means residing as SAP surplus belongs to SAP, which is a portfolio dedicated to the pension rights. When means from SAP surplus are transferred from LSH to the Bonus Potential, they will enter the investment business area.

Investment Portfolio (INV) Portfolio which invests on behalf of ATP's Bonus Potential. The portfolio should balance the long-term aspiration of indexing pension benefits against the probability of a low funding ratio.

Market Return Portfolio (M) The asset portfolio comprised of contributions to annuities with market exposure and their related accumulated investment returns. The portfolio was added as part of "new business model" in 2021.

New business model Change of the ATP act in 2021 which was also intended to expand ATP's investment flexibility and enable a higher overall ATP Lifelong Pension, while maintaining its ability to provide financial security for its members. The new business model includes two changes: the Life Annuity with Market Exposure and the amended hedging strategy. The amended hedging strategy, utilize the illiquidity in ATP's liability by applying IFRS 17, to create the Long-term Supplementary Reserve, which is used to act as risk capacity for the Supplementary Hedge Portfolio. See Section 5.5.6 for description.

Other factor The Other factor represents exposure to risks not captured by the three factors: Equity, Rates, and Inflation. For illiquid investments the Other factor captures the risk due to illiquidity and being a forced seller. For liquid investments, it reflects alternative risk premium strategies, but also asset specific risk, such as prepayment risks in mortgage backed bonds. See Section 6.3 for further details.

Rates factor The Rates factor represents exposure to interest-rate-type risk. This includes risks related to nominal interest rates, and is represented by major nominal government bonds. See Section 6.3 for further details.

Risk-seeking Portfolios The union of the Investment Portfolio, the Supplementary Hedge Portfolio and the Market Return Portfolio. It is the portfolios that are designed to generate excess return above the return required by the Guaranteed Benefits.

Supplementary Hedge Portfolio (SAP) Portfolio which invests as a long-term supplement to the Interest Rate Hedge Portfolio. The portfolio was added as part of "new business model" in 2021. It is designed to earn a spread over the return in the Interest Rate Hedge

Portfolio, and its risk capacity (due to the illiquid nature of ATP's liabilities) is generated by the Long-term Supplementary Reserve.

Treasury Portfolio The Treasury Portfolio manages ATP's liquidity, ensures cash is available to pay benefits, posts collateral and margin, manages currency hedging, and provides internal funding to other portfolios. In contrast to the other portfolios on ATP's asset side, it does not correspond to a separate liability item, but rather utilizes excess liquidity released in the Interest Rate Hedge Portfolio via interest rate swaps to fund leveraged positions in the Risk-seeking Portfolios.

ATP governance

Board of Representatives One of two boards at ATP. The other one is the Supervisory Board. Normally the Board of Representatives congregates once a year to approve the annual report, salary policies for ATP's upper management and material risk takers and topics raised by the Supervisory Board. The composition of the Board of Representatives is prescribed by the ATP Act. It is comprised of a chairman as well as 30 members, appointed by the Ministry of Employment, of which 15 are from the employer side and 15 are from the employee side. The Chairman is appointed by the Board of Representatives; the Chairman may not be affiliated with any employer or employee organization.

Discount curve ATP uses a discount curve of risk-free zero-coupon interest rates to discount the cash flows of the Guaranteed Benefits. The risk-free interest rates are determined by a basket of German and Danish government bonds, as well as EUR and DKK interest rate swaps. For maturities up to 30 years, the curve is estimated directly from market data, while for maturities beyond 30 years the curve is extrapolated by assuming a long-term constant forward rate. See Section 5.5.2 for further details.

ES(99 pct, 3M) At ATP, risk is expressed using Expected Shortfall (ES) with a 99 pct confidence level over a three-month horizon, with the shorthand notation of ES(99 pct, 3M)—see Appendix D for further details. The measure assumes an instantaneous shock, that is, no portfolio rebalancing or other management actions. This common metric allows ATP to aggregate different sources of risk (market, insurance, and operational risk) into a single measure of potential loss. Board limits are typically defined through this risk measure.

PAL tax This is the tax levied on the annual investment return irrespective of the source of the investment income and is calculated on a mark-to-market basis, meaning that unrealized

gains are also included in the taxable return. It applies to returns on the wealth of any member or customer at Danish pension funds and life insurers. In the ATP case all of the AuM belongs to the members and hence all of the AuM is subject to PAL tax. The current tax rate is 15.3 pct. A negative return in any given year will give rise to a tax asset.

Private Equity Partners (PEP) ATP Private Equity Partners (ATP PEP) was founded in 2001 as the independent private equity arm of ATP. PEP invests on behalf of ATP in private equity assets, predominantly acting as a fund of funds investor.

Supervisory Board One of two boards at ATP. The other one is the Board of Representatives. The Supervisory Board is responsible for the overall leadership and sets ATP's risk profile, strategy, key policies and investment limits. It approves pension and reserve assumptions as well as proposed legislative changes before request of such are made to the Danish Parliament. The Supervisory Board also issues written guidelines to the CEO. The composition of the Supervisory Board is prescribed by the ATP Act, and the CEO is appointed by the Supervisory Board. The Supervisory Board is composed of members of the Board of Representatives and comprises six employer representatives, six employee representatives, and the Chairman of the Board of Representatives.

Finance terms

Alpha A measure of "outperformance" versus an investment benchmark. In a performance regression of the excess return on an investment on the excess return on the relevant benchmark (reference index), the regression constant alpha, α , is the investment's excess return over and above the benchmark's excess return while controlling for the β exposure (see also beta). Hence, the α measures whether an investors' implementation outperforms the benchmark index after adjusting for how much β exposure the investor actually had to the benchmark.

Appraisal ratio The appraisal ratio is a reward-to-variability measure for active risk-taking as presented in the [Treydor and Black \(1973\)](#) framework. Here, active deviations from the benchmark result in active risk, which is captured by the volatility of the regression residual, σ_ϵ . The appraisal ratio is the ratio between α (see also alpha) and σ_ϵ . The appraisal ratio measures the reward in expected return per unit of active risk.

Basel III framework is a set of international banking regulations developed by the Basel Committee on Banking Supervision (BCBS) to strengthen the regulation, supervision, and risk management of banks. The framework was introduced in response to the Global Fi-

nancial Crisis of 2007-2008 and aims to improve the resilience of the banking sector by increasing capital requirements, introducing liquidity requirements, and enhancing risk management practices. The Basel III framework is designed to ensure that banks have sufficient capital and liquidity to withstand financial shocks and maintain stability in the financial system.

Beta A measure of the investment's sensitivity to its benchmark. In a performance regression of the excess return on an investment on the excess return on the relevant benchmark (reference index), the regression slope beta, β , measures the expected impact on the investment's excess return given a realized excess return on the benchmark index.

Capital allocation line (CAL) The CAL is formed by taking the portfolio with the highest risk-return trade-off (the mean-variance efficient portfolio) in combination with a risk-free asset. For high volatility levels, this involves leverage—taking a position in the efficient portfolio that is greater than 100 pct and a short position in the risk-free asset (or a position in the risk-free asset that is less than 0 pct).

Capital asset pricing model (CAPM) The capital asset pricing model (CAPM) is a model used to determine a theoretically appropriate required rate of return of an asset, to make decisions about adding assets to a well-diversified portfolio. The model takes into account the asset's sensitivity to non-diversifiable risk (also known as systematic risk or market risk), often represented by the beta, β , as well as the expected return of the market and the expected return of a theoretical risk-free asset. The Capital Asset Pricing Model was developed by [Sharpe \(1964\)](#), [Lintner \(1965\)](#) and [Mossin \(1966\)](#).

Concentration risk The risk that a portfolio of assets is overly exposed to, for example, a single asset, issuer, sector, or country, such that adverse developments in that exposure can have a disproportionately large impact on the portfolio's value. All risky assets, sectors, countries etc. carry idiosyncratic risk, which is only diversified if concentration risk is sufficiently low.

Constant proportion portfolio insurance (CPPI) Under CPPI, the fund takes more investment risk when assets are safely above the floor and reduces risk as assets approach the floor. In more technical language, CPPI is a portfolio rule that allocates a fixed multiple of the surplus above a specified floor to risky assets, with the remainder invested in risk-free or liability-matching assets. In the ALM context, the natural benchmark for the floor is the present value of the liabilities, or equivalently the asset value corresponding to a funding ratio of one. See [4.1.6](#) for further details.

Efficient portfolio (or mean-variance efficient portfolio), the portfolio with the highest risk-return trade-off or Sharpe ratio. The efficient portfolio lies on the mean-variance frontier and historically has taken approximately equal weights in different asset classes, or a risk-parity portfolio.

Expected Shortfall (ES) Generally, Expected Shortfall represents the average expected loss, across all losses in the lowest set fraction of probability mass of a distribution. At ATP, risk is expressed using Expected Shortfall (ES) with a 99 pct confidence level over a three-month horizon, with the shorthand notation of ES(99 pct, 3M)—see Appendix D for further details. The measure assumes an instantaneous shock, that is no portfolio rebalancing or other management actions. This common metric allows ATP to aggregate different sources of risk (market, insurance, and operational risk) into a single measure of potential loss.

Factors An investment factor is a systematic, persistent driver of expected asset returns. Factor risk premiums exist because they represent compensation for bearing risk, structural market frictions, or from investors' behavioral biases. Factors operate at two levels. At the asset class level, factors capture broad risk premiums that distinguish one asset class from another—for example, the equity risk premium or the credit risk premium. Within-asset-class factor risk premiums capture return differences among similar securities, like value, size, momentum, and quality within equities or carry within fixed income.

Global Financial Crisis (GFC) The Global Financial Crisis was a worldwide financial and economic crisis triggered by the collapse of housing markets and excessive lending to high-risk borrowers leading to severe losses in most risky assets and a worldwide economic downturn, where governments and central banks across many countries opted for extensive bailouts, severe market interventions, such as quantitative easing, and stricter regulatory regimes in the financial sector. The crisis is considered to have started mid-2007 reaching its peak in September 2008 with the collapse of Lehman Brothers. The long-term repercussions for society and financial markets of the measures used to cope with the crisis in the short term are still debated.

Gross leverage Gross leverage measures the total scale of exposures and sums the absolute value of positions. It is useful for operational and counterparty risk purposes because it shows the notional amount that must be traded, margined, and managed. This is the leverage measure typically reported in regulatory disclosures for derivative-using institutions.

IFRS 17 International Financial Reporting Standard detailing how reporting entities issuing insurance contracts account for the resulting rights and obligations. The standard describes a general approach but permits in some cases a simplified approach. The general approach requires to measure the rights and obligations based on the risk adjusted expected present value of future cash flows and an allocation of initial excess premiums over the coverage period. The standard are issued by the International Accounting Standards Board (IASB).

Liquidity Coverage Ratio (LCR) is a regulatory requirement that measures the ability of a financial institution to meet its short-term liquidity needs. The LCR is calculated as the ratio of high-quality liquid assets (HQLA) to total net cash outflows over a 30-day stress period. The LCR is designed to ensure that financial institutions have sufficient liquidity to withstand a short-term liquidity crisis. The LCR is a key element of the Basel III framework.

Mean-variance frontier The mean-variance frontier represents the combination of assets that have the lowest volatility for a given expected return. A special portfolio on the mean-variance frontier is the efficient portfolio (or mean-variance efficient portfolio) which has the highest risk-return trade-off (or Sharpe ratio).

Minimum Capital Requirement (MCR) is the minimum level of capital that an insurance company must hold to ensure that it can meet its obligations to policyholders. The MCR is calculated based on a formula that takes into account the company's risk profile, including underwriting risk, market risk, and operational risk. The MCR is designed to provide a safety net for policyholders in the event of an insurer's insolvency. The MCR is a key element of the Solvency II framework.

Net leverage Net leverage adjusts gross leverage (see gross leverage) for cash and offsetting positions and is closer to the balance sheet's economic exposure, compared to gross leverage. Net leverage is not risk-weighted: one Danish krone of equity exposure and one krone of bond exposure count the same even though equity and bonds have different underlying risk.

Public market equivalent (PME) The PME compares the performance of a portfolio of illiquid investments against a public market benchmark. It determines if a private investment has generated a better return than if the same capital had been invested passively in the public market, by modeling how the fund's cash flows would have performed over the

same period. A PME greater than 1.0 indicates outperformance of the private market investment, while a value less than 1.0 suggests underperformance compared to the public market index. PMEs at ATP are calculated using the methodology advocated by [Kaplan and Schoar \(2005\)](#).

Replacement ratio The ratio between pension payments and income while employed.

Risk parity An investment strategy which allocates capital so that each asset class or investment strategy contributes an equal share of total portfolio risk, rather than an equal share of capital. Economically, the risk-parity portfolio is formed by taking the portfolio with the highest risk-return trade-off on the efficient frontier and then taking leverage to scale up the portfolio to a target risk level.

Sharpe ratio The excess return of an asset or portfolio (return minus the risk-free rate) divided by its volatility. It can also be defined in terms of the expected excess returns of the asset (the expected return minus the risk-free rate) divided by volatility. It is named after Nobel Laureate William Sharpe.

Solvency Capital Requirement (SCR) is the amount of capital that an insurance company must hold to ensure that it can meet its obligations to policyholders with a 99.5 pct confidence level over a one-year period. The SCR is calculated based on a risk-based approach, taking into account the company's risk profile, including underwriting risk, market risk, and operational risk. The SCR is designed to provide a higher level of protection for policyholders than the MCR. The SCR is a key element of the Solvency II framework.

Solvency II Regulation in the European Union that codifies and harmonizes the EU insurance regulation. Primarily, it concerns the amount of capital that EU insurance companies must hold to reduce the risk of insolvency. The regulation is based on three pillars: quantitative requirements, governance and supervision, and reporting and disclosure requirements. The regulation is issued by the European Commission.

Tracking error (TE) The tracking error is a measure of the risk in an investment portfolio that is due to active management decisions made by the portfolio manager; it indicates how closely a portfolio follows the index to which it is benchmarked. The tracking error is measured is the standard deviation of the difference between the portfolio and index returns.

Unencumbered cash This measures the liquid resources available to meet collateral calls, margin requirements, and other funding needs. This measure is especially important for ATP

because much of its leverage is implemented through derivatives, where margin calls can be large during market crises.

Weighted average cost of capital (WACC) The weighted average cost of capital (WACC). is the rate that a company is expected to pay on average to all its security holders to finance its assets. The WACC is commonly referred to as the firm's cost of capital. Importantly, it is dictated by the external market and not by management. The WACC represents the minimum return that a company must earn on an existing asset base to satisfy its creditors, owners, and other providers of capital, or they will invest elsewhere. The WACC is used to calculate return requirements on (illiquid) investments.