

Higher Pensions and Less Risk: Innovation at Denmark's ATP Pension Plan

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While coming to grips with the challenges of market turbulence, repeated financial crises, and the 2001 introduction of a fair value disclosure regime, Denmark's Labour Market Supplementary Pension Plan (ATP) concluded that its approach to pension management needed to change. As a result, the organization began to look for a new business model. The goal was to reconcile a return-seeking investment strategy with safeguards to pensions and pension promises through sustainable guarantees and effective risk management. This article describes the resulting series of innovations at ATP designed to provide better pensions for its membership at no additional cost.

Keywords: Investment Strategy, Liability Hedging, Pension Management, Risk Management, Sustainable Guarantees, Pension Product

ATP and the Danish Pension System

With assets under management totalling US\$70 billion (year-end 2009) and a membership of 4.6 million, ATP is the largest pension fund in Denmark, and among the largest in Europe. It is a statutory pension fund set up in 1964 with the objective of supplementing the universal state funded basic pension benefit. The pension benefit is a deferred life annuity payable from age sixty-five, with a few simple choice options. Pension rights are nominal with future indexation depending on the current financial situation of the fund. A World Bank working paper on ATP (Vittas, 2008) describes ATP as "effectively operating a hybrid scheme with elements from both defined contribution and defined benefit plans."¹ Appendix 1 provides more details on ATP.

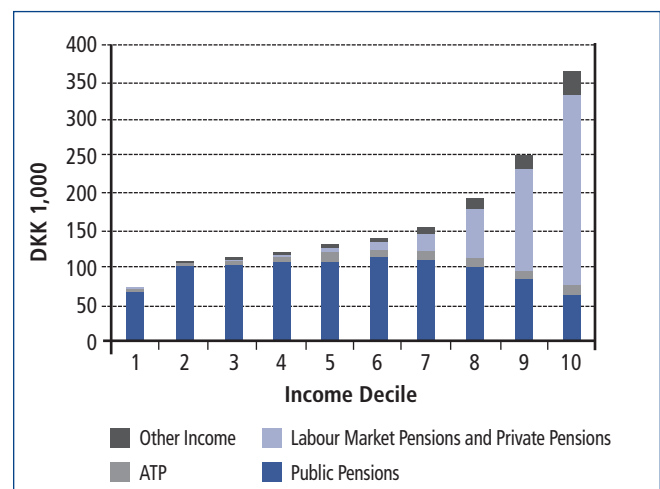
ATP plays an important role in the Danish pension system, which can best be described as a three-tiered pyramid:

- The first tier includes a universal, state-funded pension benefit financed by general tax revenue and paid to all old-aged residents, as well as the benefits provided through ATP.
- Labour market pensions make up the second tier. They are collective insurance-based multi- or single-employer schemes topping up first tier pensions in order to provide a target income replacement rate.
- Private individual pensions are the third tier of the pyramid. They either supplement pensions from a labour market scheme, or fund pensions based on personal preferences.

First tier transfers make up approximately 60% of the income of Danish old-age pensioners today, with only one in four pensioners receiving substantial income from labour market

pensions or private individual pension schemes (see Figure 1). As the system matures, this situation will change and the importance of private pension benefits will increase, particularly for middle-income earners as its coverage among pensioners will expand. However, even in the longer term, Tier 1 pensions will play a key role for the majority of pensioners providing 45-50% of the total pension income of Danish pensioners. Despite its size, ATP plays a relatively modest role in the overall pension system providing approximately 6% of the income base of current old-age pensioners. The modest current role of ATP is a function of the complex history of Danish pension politics.

Figure 1: The Income of Danish Old-Age Pensioners by Source and Income Decile in 2008



Source: Statistics Denmark and ATP 2010.

Recent Regulatory Reforms and Future Challenges

Looking ahead, increases in life expectancy are expected to continue, and remain a key political and financial challenge. A political response in Denmark has been to increase the retirement age from sixty-five to sixty-seven by 2025 and henceforth indexing the retirement age in line with longevity. Looking even further ahead, longevity forecasts made by ATP suggest a retirement age of seventy-one is possible by 2050. Meanwhile, ATP's financial reserves began shrinking some ten years ago, due to poor financial markets, high risk factors in the portfolio, and falling interest rates.

In July 2001, the Danish Financial Supervisory Authority (FSA) introduced new financial regulations which fundamentally changed the rules of the game for ATP. The centre piece of the financial reforms was the introduction of marked-to-market valuation of pension liabilities. The FSA also raised the required standards of risk management, risk assessment, and transparency. A key element was the requirement to conduct resilience tests, or *traffic lights*. The net effect of this new procedure was to tighten the overall solvency requirements for all Danish financial institutions including ATP.

ATP Redesigns its Business Model

The FSA developments were the catalyst that led ATP to rethink its mission and its strategy for accomplishing it. This multi-year process involved eight elements, organized into three categories:

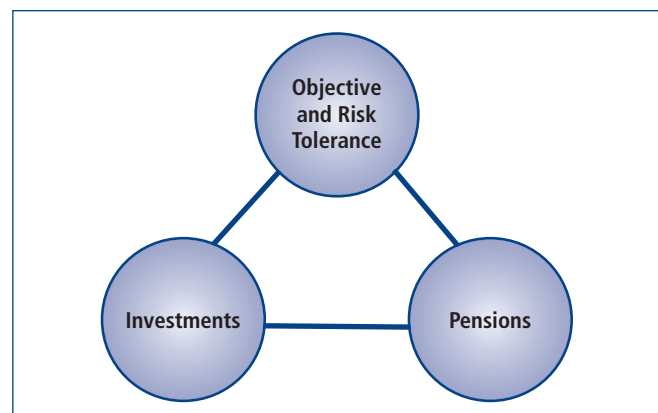
1. **On the overall business side**, ATP:
 - Adopted a new integrated view of pension management.
 - Created a new business area - liability hedging.
 - Fundamentally redesigned its risk management practices to provide timely warnings of changes in risk patterns.
2. **On the investment side** the overall strategy was redesigned by:
 - Adopting an absolute return strategy.
 - Separating beta and alpha portfolios.
 - Entering into strategies to hedge tail risk.
3. **On the liability side**, ATP developed and implemented:
 - A new pension accrual model preserving important features from the old model, while designing the new model to continually balance the accrual of new pension rights with economic realities and the investment policy.
 - A new mortality model designed to capture and address the longevity risk.

An Integrated View of Assets, Liabilities, and Business Objectives

A pension fund's overall objectives and risk tolerance, investment policy, and pension policy constitute the three key focus areas of pension fund management (see Figure 2). Integrating decisions in these three areas is a critical governance challenge. For example, a decision to increase equity exposure will not immediately affect the liability side. However, if this move leads to higher returns, reserves would grow, allowing indexation or other pension increases. Similarly, changes on the liability side can impact investment policy. For example, if life expectancy increases, pension liabilities increase and reserves decrease. This in turn reduces the ability to take on investment risk.

Overall, a risky long-term investment strategy makes little or no sense if a fund's tolerance for a *red light risk*² is low, while the policy of indexation on the other side of the balance sheet involves expedient consumption of the reserves. The challenge is to design and implement strategies and policies that are consistent with the overall objectives, and that take into consideration the relationship between the asset and liability sides of the business model. These realities now play a vital role in ATP's management process. An inhouse-developed ALM model ensures that allocations to risky assets are dynamically controlled as a function of the size of the reserves, and ATP's risk tolerance. Box 1 summarizes the four principles guiding ATP's business model.

Figure 2: The Interdependence of Three Areas in Pension Management



Source: ATP.

Box 1: Four Key Principles Guiding ATP's Investment Business

1. Appropriate risk level → the investment risk is defined in view of ATP's free reserves
2. Avoid uncompensated risk → liabilities are hedged in full
3. Diversify aggressively → the portfolio should do well, rain or shine
4. Hedging tail risks → solvency should be protected by hedging against black swan events

Hedging as a Separate Business Area: Two Goals – Two Portfolios

ATP follows a uniform investment strategy across its entire plan membership. There are two investment objectives: protect ATP's reserves against adverse developments in financial markets; and, create excess return in order to ensure the purchasing power of pensions throughout continual indexation. These objectives have led ATP to divide its investment assets into two independent portfolios with contrasting objectives. The *hedge portfolio* is intended to eliminate marked-to-market risk on existing liabilities, while the *investment portfolio* should deliver additional returns.

We noted that the marked-to-market valuation of liabilities was introduced in the midst of the 2001 financial crisis. On this basis, it was clear that ATP faced a significant risk of insolvency due to falling interest rates and highly volatile markets. There was a 30% risk on a five-year horizon that ATP would lose its entire reserves. The calculations further suggested that ATP should seek to achieve full coverage of interest rate risks in the long run. These findings led to ATP's practice of interest rate risk hedging through swaps which cover the interest rate risks of ATP's liabilities in full. At the outset, the hedge portfolio was a pure derivatives portfolio, but gradually the portfolio has changed to incorporate other types of assets. However, it is not expected to generate excess returns, and under normal circumstances it will not.

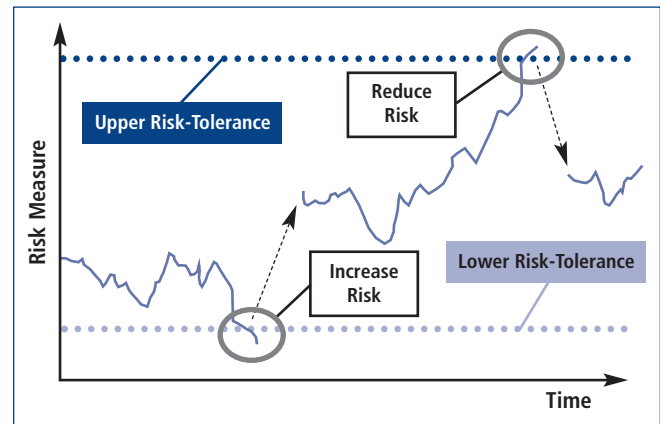
Generating excess returns requires taking on some investment risk. This is the objective of the investment portfolio. Specifically, its goal is to maintain the purchasing power of pensions through indexation. As the hedging portfolio predominantly consists of derivatives, it does not in itself consume liquidity. In principle, all ATP assets are available to the investment portfolio. Both the hedging and investment portfolios have their own risk budgets. The types of risk that each portfolio can take on is closely defined and monitored, and they cannot borrow risk from each other.

Improving Risk Management Using the Dynamic Risk Budget

The investment portfolio ideally produces higher pensions for members. However, if the other side of the coin (i.e., the risk of losses) is not addressed, future pension payments may be compromised. To address this trade-off, ATP employs a dynamic risk budgeting discipline.³ Ideally, risk tolerance is reduced from its normal level before a threat materializes. This requires analyzing and determining when, and by how much, the risk profile is to be altered in advance. Foresight is necessary, as the ability to trade is often hampered in times of financial crisis or stress, possibly leading to severe losses.

As a result, ATP applies a dynamic rule stating that the risk budget has to change when the risk of experiencing a red traffic light incident within the next three months becomes either too high or too low (see Figure 3). If the risk is too high, the investment strategy is altered immediately to prevent further losses. The sale of risky assets ceases when the risk level is re-established at an appropriate level. On the other hand, if the red light risk becomes very low, ATP will move to incrementally increase its risk tolerance, reducing the risk of buying a bulk of assets when they could be overpriced. If ATP's red light risk lies between the two extremes, the short- and long-term targets are given their normal weights. Box 2 describes the dynamic rules in greater detail. ATP's Board of Directors approves the overall framework as well as the relevant limits, proportions, and numbers.

Figure 3: The Dynamic Risk Budget



Source: ATP.

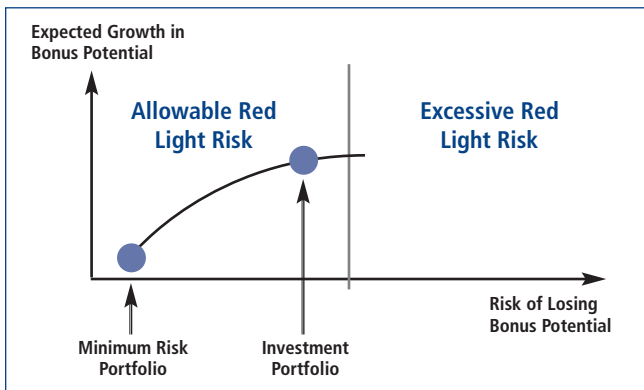
Box 2: Operational Guidelines for ATP's Dynamic Rules

1. If the risk tolerance level becomes too high, the portion of risky assets in the risk portfolio is reduced by one percentage point every fifth weekday after the desired risk tolerance level has been exceeded. If risky assets comprise more than 30% of the total risk portfolio, then risky assets are reduced by two percentage points at the same rate.
2. The risk goal or optimal risk level of the risk portfolio is calculated on a daily basis, adding ten percentage points of risky assets to the equation for the sake of prudence. If the risk does not exceed the risk tolerance in the given test period, the portion of risky assets in the risk portfolio is increased by one percentage point. A test period is between one to four months before a new quarter. The changes to the risk level are applied in the new quarter.
3. As a rule, the risk portfolio can contain a maximum of 55% risky assets. The actual risk in the investment portfolio must not exceed the amount of risk in the risk portfolio.

Implementation Strategies

Figure 4 shows how the risk budget sets limits on risk in the investment portfolio. The higher the risk in an efficient investment portfolio, the higher the expected growth of the reserves. However, the risk of losing part of the reserves is also higher. The vertical line indicates the maximum allowable risk set by the dynamic risk budget in the investment portfolio. The key function of the dynamic rule is to provide timely warning. This requires a strong administrative function providing daily updates of the real financial status of the fund, including a full profit / loss ATP balance sheet. This process does not involve forecasting. Instead, it produces an up-to-date snap shot of current risk capacity, and facilitates continual adjustments in the investment portfolio.

Figure 4: Dynamic Risk Budgeting Ensures an Appropriate Risk Profile



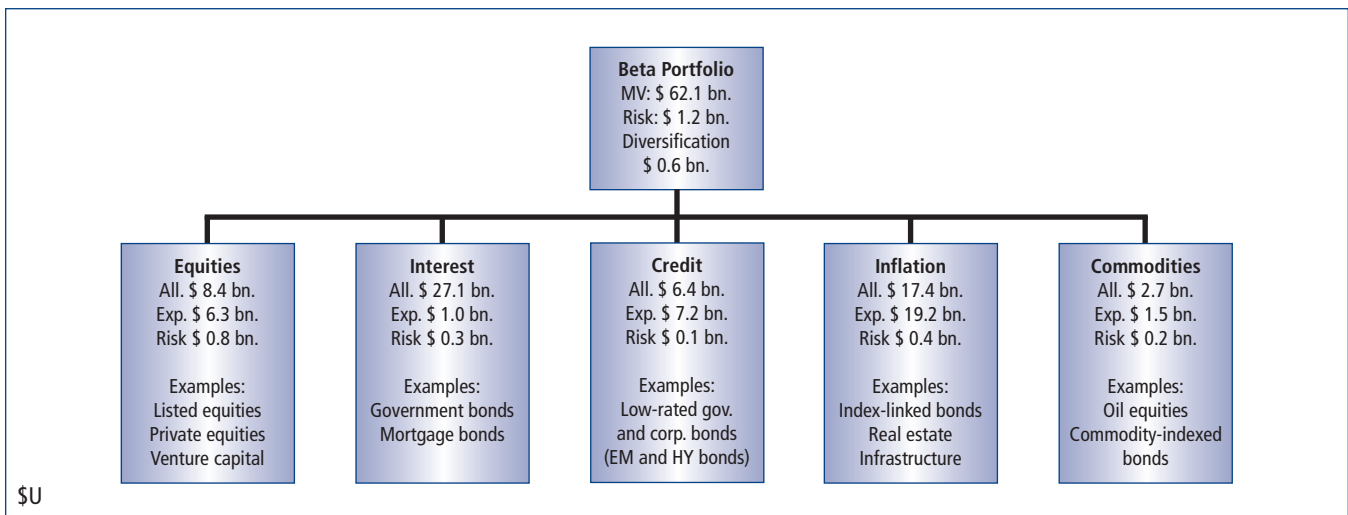
Source: ATP.

The ATP risk management protocol avoids solvency traps such as being forced to reduce unhedgeable risks in times of high volatility and negative returns, or being unable to take on additional risk when risk decreases and mean reversion sets in. These problems are avoided by how risk is measured in the risk budget model. The focus of measurement is not on absolute solvency, but on the risk of experiencing a red light situation within a three month period. Even under severely adverse conditions sufficient reserves will be available to take on additional risk.

Figure 5 shows that for implementation purposes, the investment portfolio is divided into five risk classes: equity, credit, interest rates, commodities, and inflation-protected assets. Investment decisions are guided by risk budgeting and monitoring specific types of risks, rather than by traditional asset classes. For example, a specific equity investment may be categorized as an inflation-hedging asset based on its risk properties.

The risk management protocol recognizes that even the hedge portfolio carries a certain amount of risk. This is because ATP's sizeable portfolio of interest rate swaps is denominated in Euros, while pensions and promises are denominated in Danish Kroner. To protect against losses from interest rate discrepancies between the European Central Bank and the Danish Central Bank, ATP calculates and sets aside a portion of its reserves to cover this risk.

Figure 5: Distribution of the Beta Portfolios as Different Risk Classes (year ending 2009)



Source: ATP.

Adopting an Absolute Return Target

The dual challenge in the investment portfolio is to maintain high, yet stable returns in order to secure the purchasing power of pensions, while simultaneously avoiding severe losses. Such losses would reduce the reserves here and now, and hamper the ability to have a significant proportion of risky assets in the portfolio going forward. This in turn would impact the ability to index pension benefits in the future. Specifically, we define the goal of the investment portfolio to achieve a return net of taxes⁴ at least equal to liability hedge funding costs, changes in longevity, and indexation of pensions and pension rights in line with inflation, as shown in Box 3.

Note that this return target is absolute rather than relative. Thus the focus of ATP's asset management is on overall investment risk and aggregate return. In our case, it makes little sense to apply traditional benchmarks to guide the investment portfolio. Our approach differs from the traditional benchmark-based asset management framework in that the focus is on creating a return (alpha) over and above that of a benchmark portfolio. In our view, the traditional approach often focuses too much on risk relative to the benchmark, and not enough on risk in relation to the balance sheet reserves, which is what ultimately matters.

Box 3: Objective of the Investment Portfolio

Absolute Return Target of the Investment Portfolio

$$(1-t)a = ((1-t)r + d + i)GY$$

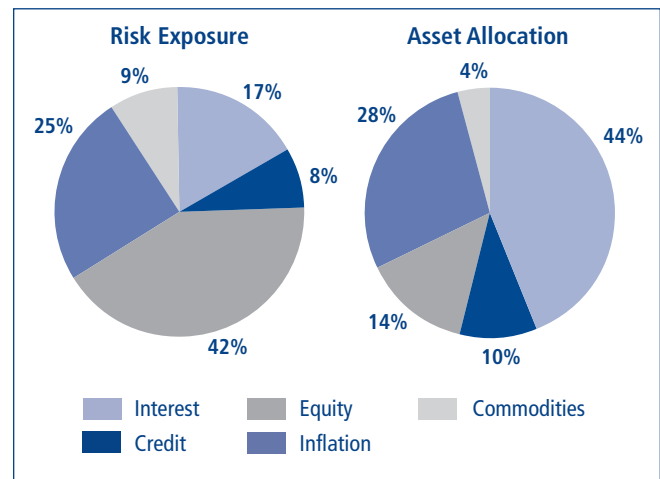
- a = the absolute return before tax
- GY = market value of liabilities
- d = longevity (percentage of GY)
- t = tax rate on investment returns
- r = money market rate
- i = inflation

Separating Beta, Alpha, and Hedging Tail Risks

To maximize the probability of reaching the desired return, the risk budget must be implemented effectively. There are two independent sources that can generate higher returns – beta and alpha. The beta source takes systematic market risks by investing in a variety of different assets in different risk classes. The expectation is that over the long run, this approach generates higher returns compared to risk-free investments, because investors demand a premium for taking on risks that are not easily diversified. Figure 6 sets out the year-end 2009 beta composition of ATP's investment portfolio.

Risk is allocated to these five investment categories so as to avoid overemphasizing one particular class such as equities. Figure 6 reveals that the share of the overall risk held by a specific asset class such as equities may be very different from its fraction of the actual assets. Through aggressive diversification, the investment portfolio should not experience catastrophic losses in adverse markets.

Figure 6: ATP's Risk and Asset Allocation by Year-End 2009



Source: ATP.

The alpha source of returns arises from active investing over short horizons. In principle, returns from alpha and beta should not be related. ATP has chosen to separate investment decisions regarding alpha and beta by creating two separate investment teams that make independent decisions. This separation contrasts sharply with traditional asset management. Typically there are sequential decision-making processes, based on a policy benchmark consisting of multiple assets classes selected to satisfy long-term return goals. Once the policy benchmark is in place, implementation decisions for each asset class are made separately. This approach is problematic in the sense that it limits the active management taking place within each asset class. This eliminates the possibility of taking advantage of mis-pricing opportunities across asset classes.

Risk diversification offers no guarantee against severe losses. There will be times when losses are far greater than predicted by mathematical models. The year 2008, for example, saw plunging prices simultaneously across all risky asset classes. Protecting the fund against such black swan events is crucial. ATP has developed a comprehensive insurance strategy in order to address this challenge. Taking the premium on relevant insurance arrangements into account, the strategy focuses on asset classes where severe losses can dominate the overall return of the fund. This typically involves the use of options.

Redesigning the Pension Policy

In addition to its innovations on the investment side, ATP developed a new pension accrual model which was introduced in 2008. Under the old model, new guaranteed pension rights were earned based on a fixed discount rate of 2%. Against the backdrop of the marked-to-market regime and in order to protect its liabilities, ATP hedged liabilities in the market place through swap contracts. These contracts usually offered a long-term interest rate higher than the applied 2% discount rate. Thus the old model provided lower guarantees than could be acquired in the market place, and created a systematic yet unintended redistribution from younger to older members.

The objective in developing a new pension accrual model was to be able to adapt more readily to the complex realities of market fluctuations and marked-to-market valuation. At the same time, key features from the old model were retained, and its social objectives and values were maintained. The new model should provide a lifelong, guaranteed pension, and accruals should be based on collective insurance principles. In effect, ATP should continue to be a defined contribution model in the sense that benefits reflect individual contributions made, while resembling a defined benefit scheme through the applied guarantee.

The key principle of the new model is straight-forward. All contributions are divided in two parts: a guarantee contribution; and, a bonus contribution, with 80% going to the guarantee and 20% going to the bonus. The member acquires a guaranteed nominal pension based on the guarantee contribution, while the bonus contribution is allocated to the reserves as an explicit payment for the right to take part in future indexation of pension rights. The minimum guarantee rate is set equal to the current market rate for one year at a time and in advance. This ensures a one-to-one correspondence between incoming (guarantee) contributions and the related liability incurred by ATP. Hence the model eliminates the unintended redistribution associated with the old model, and will typically be based on a higher rate than the traditional 2% actuarial rate.

Higher Pensions

The new pension model captures risk premiums in hedging the incurred liability. The pension calculation is based on long market rates, and all pension guarantees are fully hedged by long date interest rate swaps or similar transactions. With a positively-sloped yield curve, these long market rates offer higher risk premiums and these are captured by the liability. Thus the model provides higher expected pensions at essentially no additional risk. The model consistently preserves guarantees with the dynamics of capital markets and overall financial

developments. Even so, internal analyses applying conservative forecasts predict that a 20-year-old can expect a pension at age 67 about 20% higher than under the previous model.

Bonus contributions provide risk capital for new pension rights as they are allocated to the free reserves. Free reserves serve the dual purpose of providing the basis for financing indexation and of providing risk capital for investments. The larger the free reserves, the greater the risk capacity and the greater the expected long-term return. The size of the reserves required is managed using the dynamic rule. ATP's bonus policy stipulates that pensions may be increased if the funding ratio (reserves divided by guaranteed benefits) exceeds 120%. In the event of bonus allocation, all pensions and all pension rights are increased by the same percentage. Predictions suggest that the average funding ratio will stabilize at 125% in the long-term.

Improved Modelling of Longevity Development

Finally, the new pension model explicitly balances longevity risk within the pool by an internally developed new cohort mortality model. Pensions are therefore calculated, updated, and fixed for all contributions made that year, taking the most recent assessment of future longevity development into account.⁵ Longevity trends are estimated from international data which is more robust than just using Danish observations. This approach will significantly reduce the longevity risk related to new accruals, and it will benefit the potential to index pensions in the future. Future allocations from the reserves into the guaranteed benefits to finance unforeseen longevity increases should be much smaller.

Results to Date: The Model Stood the Test

Some years ago, ATP faced the choice between revising the business model or paying the price for staying with outdated and increasingly redundant strategies. The choice was made to revise the business model through the eight elements discussed in this article. Based on the results and experiences over the past few years, this strategic decision has already led to a number of significant achievements and positive results. For example, ATP's -3.2% return in 2008 compares favorably with the average results of pension funds in that year. If the aggregate result of ATP's investment and hedging activities are taken into account, ATP came out of 2008 with a positive return of approximately 16% after taxes.

Because of the Danish Regulatory regime all Danish pension funds withstood the recent financial crisis with their solvency intact, realizing a positive 1.7% return over the last three years.

ATP realized an average return of 5.7% during that period because of its aggressive diversification strategy, its dynamic rule, and the hedging of tail risks. At the same time, ATP safeguarded its liabilities through its liability hedging program and came out of 2008 with its free reserves intact, and a funding ratio of 113%. By the end of 2009, ATP had fully recovered from the experience of 2008 with a funding ratio of 118%.

In short, ATP's actions over the course of the last decade offer an instructive case study of how revision of an organization's business model can control risks and provide higher pensions, despite adverse market conditions and a complex regulatory regime.

Appendix 1: A Reference Guide to ATP

ATP is a statutory contributory, fully funded, collective insurance based defined contribution pension scheme forming part of the basic Danish pension coverage – the first pillar of the Danish pension system. ATP covers almost the entire population in Denmark, i.e. wage earners aged 16 and over and recipients of social security and social assistance benefits.

The contribution is flat and based only on the number of working hours. In 2010, the full annual contribution is DKK 3,240 (about US\$580) – providing a relatively flat benefit structure. Currently a full ATP pension equals approximately one-third of the base amount of the tax-financed basic pension – DKK 65,376 annually (about US\$11,700). The taxed-financed basic pension is a non-contributory residence-based benefit forming the other part of basic pension coverage.

Based on contributions paid, members acquire the right to a guaranteed lifelong pension to be paid from the pension age (currently 65) and onwards. The acquired pension right is nominal – i.e. a certain annual amount. Technically, the pension right is a deferred annuity issued at the time of contribution payment – in principle each client has a pension made up of a series of deferred annuities, one for each year of his contribution career.

Issued pension rights are covered up front by capital settlement on a marked to market basis. Accrued rights do not include a specified guarantee of future indexation or value adjustments. Indexation is conditional, as rights are adjusted by way of bonus allowances based on the financial status of the ATP. All rights are treated equally in terms of bonus allowances and indexations provided cannot be withdrawn.

Investments, actuarial services, accounting, client services, call centres, administrative service, record-keeping, and other data maintenance are managed in-house.

Key figures (in \$U):

Members:	4.6 million (756,000 are old age pensioners)
Contributions received (2009)	\$1.5 billion
Benefits paid (2009)	\$1.6 billion
Asset value at year end 2009	\$74 billion

Endnotes

1. It should be noted that Vittas (2008) describes ATP as it was designed before the implementation of the new accrual model outlined in this article.
2. *Red light risk* refers to the traffic light stress test applied under the Danish marked to market regime. The traffic light stress test involves current monitoring of the individual pension fund's risk situation and its ability to withstand a set of well defined capital market shocks. A red light situation signifies a situation where a pension fund fails to meet the red light resiliency test. Consequently, the Danish Financial Supervisory Authority will move to enforce tight supervision on the fund and demand a reconstruction plan to be drafted.
3. When establishing a risk profile, it is imperative that the principles which decide when and by how much the risk profile is altered are carefully analyzed and determined in advance. Foresight is necessary as the ability to trade is often hampered in times of financial crisis or stress; so a pension fund can find itself locked into very disadvantageous positions that can lead to severe losses. Ideally, a standard for setting risk tolerance should reduce tolerance before a threat materializes and accommodate a long-term risk tolerance under normal market conditions.
4. Returns to investment in pension funds and other pension institutions are taxed by 15%.
5. As an increase in longevity has put pressure on the funding status of pension funds worldwide, ATP has adjusted its business model to take future mortality improvements into account. But since mortality data is characteristically noisy – yearly death rates exhibit great variability – especially when analyzing countries with small populations like Denmark, uncovering a plausible trend is complicated. The innovative SAINT (Spread Adjusted International Trend) mortality model developed in 2007 by ATP's Quantitative Research Unit, overcomes this difficulty by analyzing a reference population roughly 100 times larger than Denmark's from 18 industrialized countries. Mortality projections, including uncertainty assessment are thus derived from trend extrapolation and standard time series methods. The SAINT model is more accurate in part because it describes the population as a group of heterogeneous individuals subject to selection by taking into account frailty theory, which argues that the concentration of frail individuals is higher in younger age groups and subsequently decreases in older groups as frailer individuals tend to die earlier. This implies that the age composition of the Danish population is also changing; the proportion of elderly people is actually increasing due to improvements in health care, nutrition etc. The model has been very successful in its first year in operation, exhibited by only 0.6% additional reserves needed over the predicted amount.

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