

Factor Investing in Practice: A Trustees' Guide to Implementation

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Foreword

Factors represent certain parts in the market, which are more attractive in the long term than other parts. In the case of equities for example, leading academic studies demonstrate that momentum, small cap and low-volatility stocks systematically generate higher risk-adjusted returns. Factors can also be applied in other asset classes such as bonds. Strategically allocating toward factors is called factor investing.

The prospect of higher risk-adjusted returns is obviously appealing to institutional investors. Many are investigating the opportunities provided by factor investing. This leads to a new question: how can factor investing be embedded in the investment management process?

In this study, our focus is therefore on the practical aspects. We analyze how pension funds and other institutional investors:

- can implement new insights concerning factor investing
- work with the factors that drive asset returns as a portfolio construction tool
- change the investment models they use
- learn from peers that have already taken the steps towards implementation

We also review hurdles of the implementation process and analyze the reasons behind them.

Our findings are translated into a checklist for implementing factor investing. We find that three approaches to factor investing are emerging and we discuss case studies to examine how these approaches are implemented and correspond to our checklist.

A point about our relationship with Robeco. Robeco considers factor investing as essential for its institutional and other professional clients. It does extensive research on this matter and supports external research. This external research is not limited to the theory, but includes the challenges investors face when implementing research findings. Therefore, we were given the assignment to write this research report.

Finally, our thanks to Ramon Tol, Jaap van Dam, Pim Lausberg, Didier Duret, and Gerben Jorritsma for interviewing them and Roderick Molenaar, Joop Huij, Margret Smits, Sef Laschek and Marc van der Holst for their helpful comments and suggestions.

Tilburg, January 2014

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1 Introduction

Pension funds are changing the manner in which they express their asset allocation, from asset classes to risk classes, recognizing and managing underlying characteristics in a novel way. The large ATP Fund in Denmark now manages its asset allocation in terms of exposure to risk classes, allocating its assets to interest rate, credit, equities, inflation or commodities exposure (Jepsen, 2011).

The Alaska Permanent Fund also took a different approach to asset allocation in 2009 for the goal of building an all-weather portfolio. The Fund, managing \$45 billion at the end of 2012, groups investments by risk and return profiles as well as by the market conditions that each group is intended to address¹. Its asset allocation is now expressed in terms of allocations to “company exposure”, an asset class made up of stocks, corporate bonds and private equity. It also expresses its asset allocation in terms of interest rates, real assets, special opportunities and cash (Inklebarger, 2009).

An increasing number of pension funds and institutional investors have followed the lead of the ATP and Alaska Permanent Fund and implemented or considered focusing on the factors that drive returns, blurring the lines between active and passive management or alpha and beta. Some even suggest that a paradigm shift might be taking place (Fraser-Jenkins, Morris, Lee & Murakami, 2013). Described as factor investing, this development in portfolio construction has additionally gained traction from another angle when the Norway Fund commissioned a study into the disappointing results of active management in 2008 and early 2009. Analysis of the Norway Fund’s active management style by Ang, Goetzmann and Schaefer (2009) indicated that a significant component of performance was explained by exposure to systematic factors that fared very poorly during the financial crisis. However, the broader implication of the authors is that exposure to such factors would be more appropriate for a long-term investor, since the factors earn risk premiums over the long run. They therefore proposed that these factor exposures should be treated as part of the portfolio and benchmark construction (Ang, Goetzmann, & Schaefer, 2009), helping trustees in their decision making. The finding that performance from active management is mainly driven by factor exposures builds on the insights of Fama and French (1993), and Carhart (1997), who identify common risk factors in the returns of securities and asset returns.

The novel proposition was the recommendation that investors should consider redesigning the investment process by directly allocating to factor premiums in the strategic asset allocation as a way forward. A traditional

portfolio would be first diversified across asset classes, then allocate for instance to regions and sectors and next to (external) fund managers. A factor-based portfolio is diversified across premiums, such as low-volatility, small-cap, value and momentum premiums. Investment management practice has developed approaches to incorporate one or more of these premiums, either by developing investment strategies solely to capture one of these premiums, or by embedding them as tilts in the overall strategic asset allocation. The Strategy Council of Norway’s Government Pension Fund Global views this as “harvesting risk premia from multiple sources [which] can be seen as broadly consistent with risk parity investing, which should result in more effective diversification and avoid a heavy reliance on the equity premium” (Chambers, Dimson & Ilmanen, 2012).

This report completes a two-part series on factor investing in institutional asset management. The first paper reviewed the research literature on factor investing and extended empirical analysis to the main broad asset classes. Factors that drive the returns of equities and bonds are analyzed and tested with European data. Using clearly identifiable analyses, we see that factor-based portfolios generally produce comparable or better portfolios than market indices. The results remain robust when we add real estate and commodities to equities and bonds, making the factor portfolio more comparable to the main investment categories applied by institutional investors. This gives us room for higher returns or lower risk in line with the relevant objectives (Koedijk, Slager & Stork, 2013).

The current paper analyses how, and to what degree, factor investing can be embedded in the investment management process of (institutional) professional investors. The paper is organized as follows. We start by reviewing the current knowledge on factor investing. We identify three approaches to implement factor investing in the portfolio-management process and discuss implementation issues. Implementation from a regulatory perspective is included next, followed by our conclusions and a checklist for embedding factor investing in the portfolio management process. Finally, we illustrate the three identified approaches, including the interaction with our checklist, with case studies of PGGM, ATP and Blue Sky Group. Since these are all large institutional investors, we add a case study on the implementation for a small pension fund and for high net worth individuals as well. All the case studies are based on public information in addition to background interviews.

¹ <http://www.apfc.org/home/Content/investments/assetAllocation2009.cfm>

2 The Development of Factor Investing

Summary

- Factor investing is an existing portfolio management concept developed in the late seventies, and has been revived due to interest after the financial crises in 2008-2010 in how to improve diversification, and how to separate systematic factors in the active returns of managers.
- Factor investing seeks out systematic return/risk factors in the asset allocation process, with as few interdependencies as possible.
- These factors need to show statistical persistence, have an economic rationale and can be implemented in a straightforward way.

2.1 Diversification

For trustees and other professionals, the role of diversification is one of the central tenets in investment management, both in theory and in practice. So investors were upset when the mainstream approach to diversification hit a brick wall in 2008, spurring research into workable alternatives to improve the only free lunch in investments. That year, traditional asset allocation approaches showed significant drawbacks, such as fat tails in the return distribution and the risk of positively correlated returns during market turmoil (correlation risk). These drawbacks reduced the portfolio diversification benefits when investors needed it most (Varsani, Teeger, Heath & Egglestone, 2013).

Portfolio diversification was an intuitive, sensible thing to do for an investor, and researchers have steadily added important ideas, encompassing Mean Variance Optimization, CAPM or APT, that have shaped thinking about the meaning of diversification. Investment portfolios today compare quite differently to portfolios a decade ago, but share diversification as a central tenet.

Institutional investors warmed to new forms of diversification in the 1990s, when advanced tools like Asset Liability Management and new innovative concepts in risk management allowed investors to expand the scope of possible investments. Asset categories, hitherto available for a few savvy investors, slowly entered the portfolios but really made headways from the 2000s onwards. Investors increasingly became aware that an overreliance on traditional asset allocation to equities and bonds was characterized by high volatility and a lack of sufficient diversification, particular during periods of crisis. After the 2001-2 financial meltdown, a shift in asset allocation accelerated towards alternative asset classes such as private equity, hedge funds and commodities. These new allocations provided only part of the expected diversification. In practice,

alternative asset classes are more correlated with traditional equities and bonds than expected. Private equity provides diversification if it consists of high-alpha funds, but much of the return is structurally dependent on equities and bonds. Similarly, the majority of the long-short equity hedge funds produce returns that are highly correlated with the equity market (Bender, Briand, Nielsen & Stefek, 2010).

With hindsight many new, alternative investment strategies have suffered from two problems (Economist, 2008). First, the success of many new strategies was boosted by the same factors: low interest rates and robust economic growth. Some alternative investments share more factors: Private equity gives investors exposure to the same kind of risk as publicly traded equity, albeit with added leverage. When prospects deteriorated, investors with liquidity constraints were forced to sell those alternative asset classes simultaneously.

Second, some of the asset classes are rather small. For some of these asset classes, illiquidity can be attractive, since it can offer higher returns. As more investors get involved, the market becomes more liquid, and the higher return is eroded. However, when everyone tries to sell, illiquidity rears its ugly head – there are no buyers to be found and prices tumble. This is especially unpleasant when pension funds have to value their investment at mark-to-market.

Diversification is not uniformly interpreted and implemented by trustees and other professionals. Consider the following rationales:²

1. Reduce overall portfolio risk

Whenever two imperfectly correlated assets are placed in a portfolio, there is an opportunity to earn a greater return at the same risk, or earn the same return at a lower risk. The correlation between the new asset and the existing assets in the portfolio should reflect a sufficiently different pattern of returns, and the allocation to the new asset should be sizeable enough to matter.

2. Hedge against adverse asset-pricing shocks

If there are extreme price movements in the financial markets, will the new assets' lack of correlation disappear, and is diversification suspended? Or does the new asset provide a really new, independent (economic) source of return where it is ex-ante unlikely that it moves in-step with the other assets?

² Purposes of diversification. Taken from Koedijk and Slager (2011) and Hudson-Wilson et al. (2005).

3. Hedge against unexpected inflation or deflation

Conventional wisdom has held that assets like real estate provide a hedge against inflation. However, except for inflation-linked bonds, many assets have a complicated relationship with inflation. Many assets provide a partial inflation hedge. Inflation may raise future cash flows, but this is partially offset: inflation also increases the nominal interest rate to discount the future cash flows, decreasing the overall valuation.

4. Reflect the overall investment universe

A portfolio with 50% equities and 50% bonds might be called a balanced portfolio, but it is definitely not a reflection of the investment universe. This implies, in theory, that any portfolio that does not include for example private equity, takes an implicit bet that a portfolio without private equity yields better returns. The choice to leave out assets in the investment universe is also driven by governance issues or costs.

5. Deliver strong cash flows to the investor

Pension funds are all about liquidity, and one of their major goals is the creation of a stream of cash flows that, to a large degree, offset the pension payments to be made. Selecting asset classes with diversified, strong cash flows provide a natural hedge against pension liabilities, which are basically a set of future cash payouts anyway.

Table 1. Purposes of diversification. Taken from Koedijk and Slager (2011) and Hudson-Wilson et al. (2005)

2.2 Classification of factors compared to asset classes

Armed with this sobering knowledge, institutions began to (re)explore which purpose diversification serves within the investment process (Table 1) and what the most important factors would be to drive portfolio returns (Ilmanen & Kizer, 2012). Within this framework, which is rooted in the

Asset Classes	Factor Premiums
Equities – Mature Markets	Equity
Equities – Small Cap	Size
Equities – Emerging Markets	Value
Sovereign Bonds	Momentum
Corporate Bonds	Low Volatility
High Yield	Duration
Real Estate	Term Spread
Commodities	Emerging Markets Spread
	Volatility Spread

Figure 1. Asset Class Allocation vs. Factor Premium Allocation

Asset Pricing Theory (APT) developed in the late 1970s, any asset can be viewed as a bundle of factors that reflect different risks and rewards. So it makes perfect sense to focus on these factors, allowing investors to identify factors and understand what really drives asset returns. These insights help to develop portfolios that realize the required risk profile not only before but also during volatile periods³.

Bender et al. (2010) distinguish among three groups of factors: asset class, style and strategy premiums. The asset class premiums provide the expected compensation for investors in excess of the risk-free rate on a passive investment in a traditional, broad source of risk. Examples are equities or bonds. The “style” premium captures the return to styles in excess of a broad asset class. For equities, value, small-cap and momentum are known factors, while factors for fixed income include term structure, credit or high-yield spread. The third group of factors is generated by the execution of a strategy, such as a merger arbitrage or a currency carry trade. A return can be decomposed into a combination of asset-class returns, style-risk returns and strategy returns, while the remaining return could be denoted as alpha. Return decomposition is then straightforward:

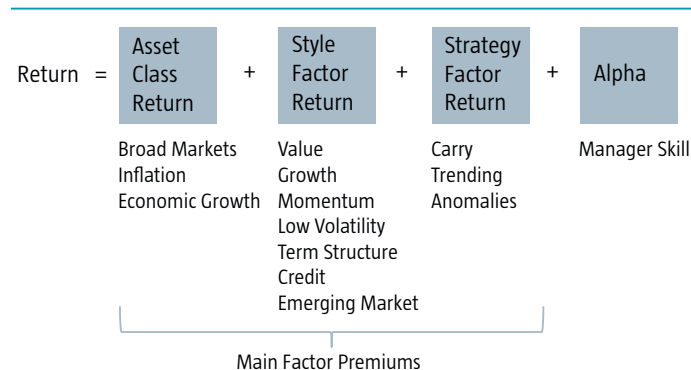


Figure 2. Return Decomposition into Factors (Bender et al., 2010; Varsani et al., 2013)

Research on factor investing is mostly based on US data. While this research provides valuable insights, the question is whether these insights are applicable for European investors, who generally have Europe biased portfolios. An earlier paper prepared for Robeco (Koedijk, Slager and Stork, 2013), investigates whether the research findings for US factor premiums are also applicable in an European context. The study investigates a number of factors for equities: market, size, value, momentum and low volatility. For bonds, term spread, long and

³ The Appendix summarizes the research around factors.

short maturity credit, high yield and short treasury were used. These factors encompass most of the style factor premiums and the strategy factor premiums in Figure 2. Furthermore, these factors have been well researched, and are implementable. The history of European data sets is generally shorter than the US one. This is not a potential drawback however; we find that the European results from 1998 mirror the US results, starting from 1975. When constructing portfolios with naïve construction rules where no additional market intelligence is required (such as 1/N), we find that these portfolios result in better return/risk profiles than market capitalization weighted indexes. But portfolios of institutional investors encompass more than bonds and equities. When we extend the analyses to commodities (cf. Blitz and de Groot, 2013) and real estate as well, the analyses are not only a better reflection of the current situation, but also yield similar results. A promising avenue is that the results do not hinge on a few factors, it is rather the use of factors per se that yield a better result. In this paper, we show that prudent investors embed this insight in their investment management process.

However, for factors to be implementable in the investment management process, investors have to consider the rationale of the factor premiums, the economic significance of factor investing, and the way to implement them.

2.3 Rationale and persistence

The origin of the premiums needs to have an economic or behavioral rationale (cf. Blitz, Huij, & Steenkamp, 2012). Without being properly founded in theory or investment practice, the factors become a temporary anomaly that may be exploited, but cannot be a structural part of the investment process. Are they related to bearing specific kinds of risks, or do they originate from irrational investor behavior or specific market failures? We can also reason the other way around: based on economic arguments, what factors should we be able to find? Identification and analysis of robustness helps the investor to sort out which of these factors are more important than others. There is already a large group of well-researched factor premiums. Since the 1990s, size, value/growth, momentum and low volatility have been widely investigated. These factors have been confirmed in several studies over longer periods of time. For several of them, we also have more knowledge in which scenarios the factors do (not) work. This is relevant for minimum volatility strategies that have been implemented in recent years, where investors lack the practical experience of the strategies behavior over a full business cycle, although academic research about such strategies spans several

decades. However, even these factors are purely empirical in nature – they do not necessarily have an economic explanation. Unlike some factors that can be understood as predictors of economic growth, the momentum factor, which is repeatedly confirmed in studies and seems persistent, has several theoretical explanations for its existence but these cannot be easily or consistently embedded in an economic framework (Tang, 2013). Even the Fama/French results might well be an example of data mining; many studies published on possible explanatory variables for stock returns. Black (1993a 1993b) suggests that the most promising ones were selected in the empirical study.

The identification of the rationale helps to determine the persistence of the premiums. For example, explanations for a number of premiums share a behavioral finance background. The central issue in behavioral finance is explaining why market participants make systematic errors⁴. Such errors affect prices and returns, creating market inefficiencies, and form a solid basis for the premiums since participants generally change their behavior very slowly.

Some factors can be quantified, in which case we can categorize them as return drivers (Hawker, 2010). But how can we be sure that all factor premiums are identified? Over the decades, factor premiums have been researched, but an integrative framework to identify them is still non-existent. Cochrane (2001) argues that many empirical studies fish for factors, but these factors are not necessarily backed by sound economic theory. These integrative economic models deduce the existence; relationship and predictive power of factor premiums based on a number of axioms and assumptions and allow researchers and investors to identify for which factors they should search. An example of an integrative model is the standard dividend discount model, teaching investors that stock returns are driven by dividend level, growth and change in the required return. The lack of an integrative model for factor investing leaves researchers searching for new underlying factors that might suggest new commonalities or for the bundling of factors that previously seemed unrelated.

There are however, more missing links. For example, an emerging markets factor premium has been identified (cf. Bhansali, 2011a), which is generally justified on the grounds of above-average returns in the stock markets and of economic growth in emerging countries. But empirical evidence in developed and emerging markets does not support the notion of a structural relationship between economic growth and equity

⁴ http://en.wikipedia.org/wiki/Behavioral_economics

returns. Explanations are that some countries are better than others at converting GDP growth into profit growth, and better growth prospects are often already reflected in market prices (NBIM, 2012). This suggests that factor premiums find their origin in other areas. For example, the size of the financial markets in emerging markets compared to GDP is low compared to mature economies (e.g. Demirgüç-Kunt, Demirgüç-Kunt, & Levine, 2004), suggesting that emerging markets are more sensitive to an increased inflow of institutional money. Also, there is a relationship between the quality of the institutional framework in a country, economic growth (Barro, 1998) and the stock market. The factor premium found for the emerging markets is then more likely a compensation for international governance risk, which is a qualitative rather than quantitative factor. This line of reasoning challenges the investor on what really drives the premium, how persistent it will be, and what underlying factor should be really looked at in the portfolio management process. Finally, some risks cannot be quantified but still are important to consider, forming as complete a picture as possible of the factors and risks associated with the investment. We can regard the equity and credit risk premiums as being return factors that can be quantified, but these factors cannot be separated from political or regulatory risk, which cannot be quantified but needs to be taken into account qualitatively to assess the exposure of the factors (Hawker, 2010). Regulation drives the quality of governance, which in turn drives required risk premiums; capital adequacy regulation drives the amount of leverage investors and financial structures can take on, influencing the co-movement of factors like liquidity and momentum.

2.4 Way of implementation

After determining rationale and persistence, the next question is to assess how large premiums are in economic terms after trading costs and investment restrictions are taken into account. Does the implementation of factor premiums marginally or substantially improve return/risk tradeoffs? As a starting point for implementation, the usual considerations, such as portfolio turnover, scalability, capacity constraints and liquidity should be taken into account. Related to this is the question about rebalancing and the turnover it generates. Another consideration is the bundling of factors. Historically, asset class and style returns have been bundled together. For example, the MSCI Value Index is composed of a broad exposure to the equity market and the value risk premium. One can isolate the exposure to a style by going long on the Value Index and shorting the Growth Index. The long-short combination would eliminate most of the market exposure and capture the value-risk premium. Bender et al. (2010) also provide an example to capture strategy premiums. Capturing the currency value premium would require short positions in currencies that are overvalued compared to their implied exchange

rate (purchasing power parity) and taking equivalent long positions in undervalued currencies. The long-short approach is not the only way, but surely an important one to capture premiums. This approach will be revisited when the different implementation approaches are discussed. For example, pension funds have investment guidelines restricting the amount of leverage or short sellers, which in turn limit the potential to earn a number of (exotic) factor premiums, especially during periods of higher volatility.

To increase investability and take advantage of the opportunity of the new developing markets around factor investing, managers have developed investment strategies around value and momentum since the 1990's. From 2007 onwards, interest in low volatility strategies increased when asset managers like Swiss UniGestion, Dutch Robeco or U.S. State Street developed these strategies. Asset managers took another step in recent years, developing ETFs that (long only) capture an expanded range of factors. While asset managers have been quick to launch these instruments, the trading volume for most of them is limited. This suggests the existence of some hurdles in the acceptance of factor investing in the investment community, which will be discussed later in the paper.

3 Embedding Factors in the Investment Management Process

Summary

- Investors can follow one of three models to embed factors in the investment management process: risk due diligence, factor tilts, and bottom up factor optimization. These models have been around in some form or another; new is the explicit use of factors next to, or perhaps instead of assets.
- The risk due diligence approach applies factors to check for unwanted concentrations, and uses the existing assets to redress the concentrations.
- With the factor tilts approach, specific factors that are potentially underrepresented in the asset allocation could be introduced, either through the use of alternative indexing or investment styles like value or momentum.
- Factor optimization is (as yet) least applied and involves a portfolio optimization based only on factors.

3.1 Introduction

While known to the reader, we briefly outline the commonly used investment management process, to use it as a base scenario to analyze how factor investing changes this process. We consider a stylized investment process (Figure 3).

Damodaran (2007) sees three characteristics of the investment process. First, the investment process outlines the steps in creating a portfolio and emphasizes the sequence of actions involved. By emphasizing the sequence, it provides for an orderly way that an investor can create his

or her own portfolio or that of someone else. The sequence of actions is usually implemented as a hierarchy in decision-making. For example, the first step typically uses a particular utility function to describe the preferences of the investor and his risk aversion. Next, the translation of risk appetite in quantifiable measures is the framework for the strategic asset allocation, which in turn is further specified in investment styles, security choice, or choice of the investment manager. This goes back to Brinson et al. (1986, 1991), who found that the choice of policy portfolio (asset allocation and resulting benchmarks) accounted for the majority of variability in returns, although this is not undisputed (Kritzman & Page, 2003). Generally, the board of trustees of a pension fund, endowment or foundation establishes the strategic asset allocation across major asset classes. Strategic asset allocation represents the institutional investors' investment policy (Anson, 2005).

Second, the investment process provides a structure that allows investors to see the source of different investment strategies and philosophies. In this way, investors are enabled to take the hundreds of strategies that are available and trace them to their common roots, helping investors to determine what choices are based on "tested and proven" investment theories and actual track records to support these theories, or novel portfolio allocation choices with more outcome uncertainty (cf. Koedijk & Slager, 2011).

Third, the investment process emphasizes the different components that are needed for an investment strategy to be successful, and by so doing

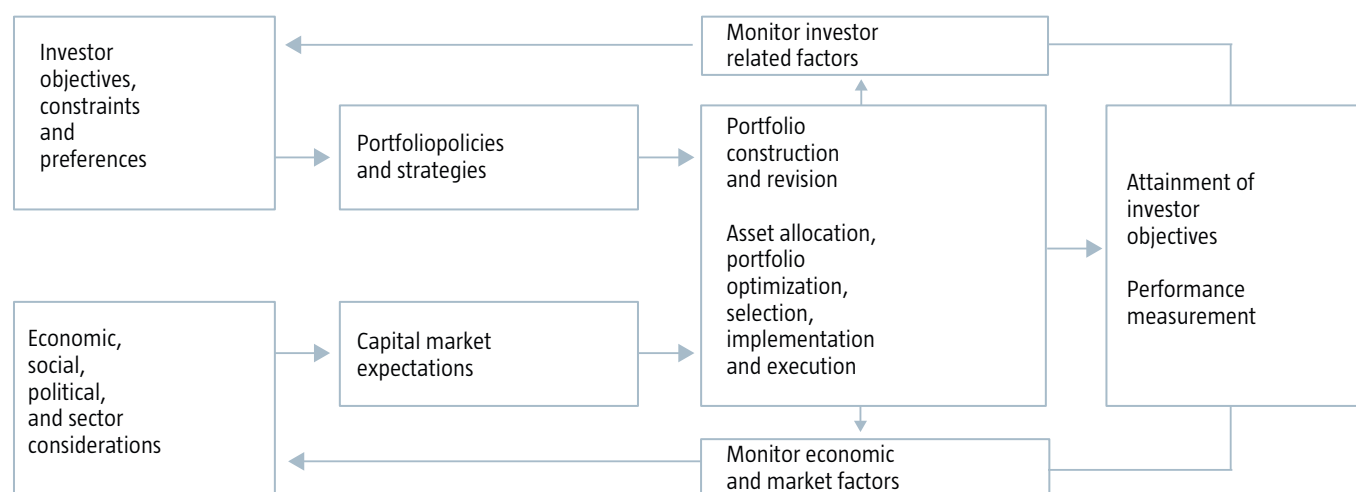


Figure 3. The Portfolio Construction, Monitoring and Revision Process.
Source: Maggin et al. (2010).

Model	Main Characteristic	Difference?	Issues for trustees
Base scenario: Return/Risk Optimization in an asset or LDI approach	Maximize expected returns given targeted risk		Existing framework for fiduciary responsibility
1. Risk due diligence	Check for unwanted concentrations in certain factors or lack of exposures	Additional insights in risk management	Higher degree of risk awareness but least potential for return enhancements
2. Factor tilts	Introduce factor tilts within asset allocation, for example with alternative indexing. Add factors that are underrepresented.	Identifiable factor strategies in addition to traditional investment strategies in place	Long-term view towards factors. Issues with rebalancing (concerns multiple factors at once)
3. Factor optimization	Optimize with factors	Completely new approach, replacing traditional investment strategies	Might be difficult for trustees to understand themselves or explain to participants

Table 2. Different Forms of Implementing Factors in the Investment-Management Process

it explains why so many strategies that look good on paper will not work for those who use them. Differences in implementation explain to a large degree performance differences among pension funds (Frijns, Nijssen, & Scholtens, 2010). For example, introducing layers of hierarchy in the investment process might increase the sense of control but reduces outperformance (Massa & Zhang, 2008).

Additionally to the three characteristics outlined by Damodaran, an investment process also outlines the feedback loops in the investment process, reflecting that capital market assumptions and client preferences change with the advent of new information. Feedback is particularly effective when it comes to managing an investment process where information is generated in an uncertain and volatile environment. When investors are assigned a goal and given meaningful feedback regarding their performance relative to that goal, they will use the feedback to adjust their actions to better match the goal. The investor must be able to interpret the information in a meaningful context, allowing him to recalibrate his behavior, make a decision and act (Cooper, 2000). That action is then measured, and the feedback loop restarts.

3.2 Models used for implementing Factor Investing

We consider how factor investing affects the investment process and outcome. Three approaches to embed factor investing are put forward:

- the risk due diligence approach,
- using factor tilts in asset allocation
- factor based optimization.

Table 2 summarizes these approaches, where we compare the characteristics to the “base scenario”. For each of the approaches, we

focus on how they alter the portfolio construction and revision process, the feedback mechanism, and the main assumptions needed to implement it successfully.

3.3 Risk due diligence

Strategic asset allocation is designed to achieve the long-term goals of the pension fund, rather than “beat the market”. The portfolio that is constructed has to pass a number of hurdles to determine whether factor premiums can play an important role. Investors are generally poorly equipped to make correct assessments about the future, yet any strategic asset allocation is forward-looking by nature. Assumptions about risk premiums and correlations between the asset classes play an important role. To examine the robustness of the portfolio, its potential performance is tested within different scenarios. This approach leaves the process unchanged but adds an additional layer that provides more insight into the drivers behind the policy portfolio, helping trustees to better assess the sensitivity of the portfolio in certain scenarios.

Equity managers have been long acquainted with this process, for example, through the use of MSCI/Barra systems, helping managers attribute the portfolio to a number of quantitative and non-quantifiable factors that drive returns. Investment consultants increasingly apply this approach in the form of a heat map, a matrix that details each factor’s exposure in the assets in the portfolio for different strategies with quantitative and non-quantifiable factors. The main advantage of this approach is that the investor gains more insights behind the drivers of the portfolio and allocates the assets in the portfolio over instruments and strategies that are familiar to him. This approach also helps the investor to determine (un)wanted concentration of factors within the portfolio. This is especially relevant for trustees, who have to consider accountability to their participants when making investment decisions. The due diligence

approach suits pension funds with certain investment guidelines. For example, considerations about leverage and portfolio turnover preclude the use of stand-alone factors. Factors that require a lot of transactions, or short positions become less desirable or might even be excluded beforehand. The disadvantage of the risk due diligence approach is therefore that the full benefits of diversification might not be earned.

3.4 Factor tilts

When constructing a portfolio, tilting factors in the asset allocation is currently the most used approach, in which pension funds use factors to complement the desired portfolio construction. Basically, the investment process stays as it is, but factor premiums are added to improve the return/risk tradeoff. Institutional investors take two different approaches, suppletion and alternative index construction.

Suppletion. Going forward, the portfolio construction process includes an inventory of the existing factor premiums in the portfolio. A large number will be captured by the current allocation to bonds and equities, leaving room for others to be added. Factors could be identified that are currently not within the portfolio by which inclusion improves the return/risk trade off. This implies that the “alternative asset” allocation could be redefined, next to e.g. commodities exposures, strategies or instruments to capture trend reversal, or volatility might be added.

Alternative index construction. Alternatively, factors are identified that should be increased or decreased in weight to improve the return/risk trade off. This is done by reconstructing the benchmark for the given asset, which is termed in this paper as alternative indexing. This term⁵ comes closest to what investors are actually doing in the investment process, i.e., constructing alternative approaches to the market-capitalization-weighted indices to capture one or more factor premiums. The vast majority of equity investment assets may still be linked to indices based on market capitalization, but many institutional investors in the Netherlands, Scandinavia and elsewhere in Europe are shifting part of the beta portion of their equities portfolios towards alternative indexing methods⁶. Within equities, the market-cap-weighted benchmark is ultimately the only one true benchmark. This is because it is the only one that all investors hold. But just because it is the only ultimate benchmark

does not mean that it is the most appropriate one for all investors (Fraser-Jenkins et al., 2013, p. 6). Three alternatives to market-capitalization-weighted benchmarks are growing. As a first alternative, the benchmark is further developed into a dynamic strategy, targeting an amount of risk or risk diversification. Minimum variance strategies tend to overweight low-volatility stocks; maximum diversification strategies aim to minimize the volatility of a set of stocks. This group of benchmarks also includes alternative weighting methods and aims to increase diversification (see Tol, 2012).

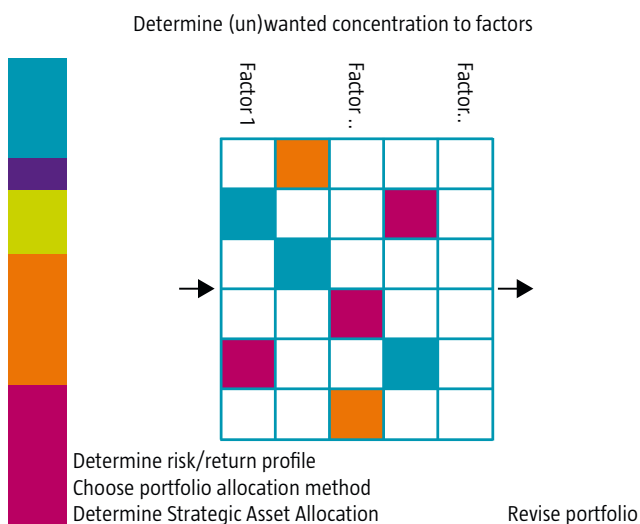
Indices are also introduced with (additional) exposure to factors. Equities are for example rated according to metrics such as book value, sales or other accounting-based measures, and a customized benchmark is created that reflects a subset of stocks with the desired characteristics. For the value premium, this would be among others a high book value to market value ratio. The investor captures both the market premium (investing in equities) as well as part of the style premium (value). Bond portfolios are increasingly constructed with GDP-weighted benchmarks to mitigate exposure to the highest debt-issuing countries. All approaches have in common that they are embedded as a strategic asset allocation choice with most pension funds. To be effective, they require sizeable allocation but the style factors also require a longer time horizon, so it makes sense to implement them in a strategic-asset allocation.

Factor premiums can also be addressed in an indirect manner. For example, investors have reassessed the market-capitalization-weighted indices, placing a cap on market weight, following the criticism of Arnott et al. (2011) on the representativeness of these indices to the required risk and return characteristics. Critics of the practice of market-capitalization weighting argue that the method leaves investors more exposed to stocks whose prices have risen strongly and overweight stocks that are fundamentally overvalued. Over the decades, such arguments have been used more to promote active management than value or growth strategies specifically.

⁵ Other terms are for example “Smart Beta” or “Alternative Beta”. There is not a uniform definition, although the explanations share for a example a critique of the market-capitalization weighted benchmark and the focus on alternative weighing approaches to construct benchmarks (e.g. Amenc et al., 2013)

⁶ Smart Beta: New generation of choices 01 Jun 2012, IPE.com, <http://www.ipe.com/articles/print.php?id=45803>

Approach 1: Risk Due diligence



- Create basic ALM portfolio based on assets.
- Check with factors for unwanted concentrations. Determine the quantitative and qualitative factors for the analyses.
- Additionally, a fund could decide which ones should be “bundled” in the analysis. “Bundled” exposures are treated as one where, for example, corporate bonds and equities share exposure to corporate earnings. This amounts to a heat map (Taken from Hawker, 2010).

	Quantitative Risk Factors							Qualitative Risk Factors			
	ERP	Size	Term	Credit	Inflation	GDP	Alpha	Leverage	Regulatory	Illiquidity	Other drivers
Developed Equity											
Emerging Markets Equity											
Commodities											
Real Estate											
Private Equity											
...											
Govt. Bond											
Emerg. Markets Debt											

Relatively high exposure to factor Relatively low exposure to factor

- Revise portfolio within given risk/return constraints
- Create benchmark portfolio
- Construct a rebalancing method based on a risk-based measure. This is work in progress for many organizations. Current concentration or exposure to factors is measured, and the portfolio allocation is changed.

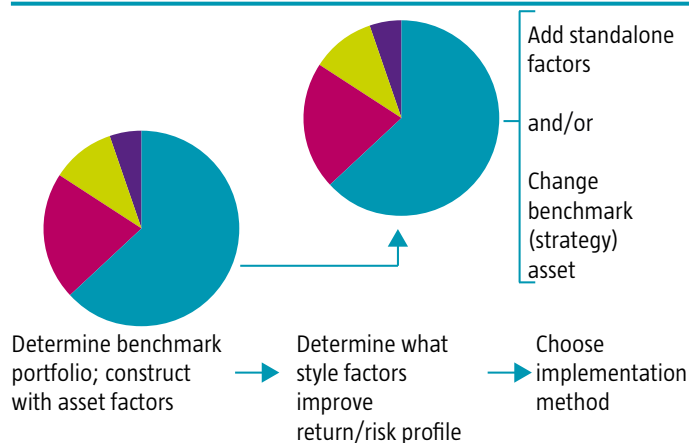
3.5 Factor optimization

Introducing factor tilts in the portfolio leaves the portfolio-management process more or less intact, creating policy portfolios and/or fleshing out specific approaches to capture style and/or strategy premiums. One step further would be to extend this factor-based approach over assets, rather than within assets. A portfolio manager could choose to construct portfolios based on factors. The portfolio optimization approach remains in place; factors are more or less applied as a layer over the portfolio. These factors can consist, to a large degree, of long-only strategies and/or ETFs. Similar to the standard optimization approach, volatilities of and correlations between the factors have to be estimated as input information. Here, these estimations are bound to be subjected to similar uncertainties and errors for factor premiums as for asset classes. Ilmanen and Kizer (2012) argue however that correlations between factors are more stable than between assets. They claim that this stability at a lower lever is exactly what makes factor investing so interesting, more so than return-enhancement.

The optimal allocation to the preferred factors has then to be translated into actual investment positions. To apply this model successfully, clients have to be comfortable with a portfolio composed of financial instruments to which they cannot intuitively relate. Here, a necessary hurdle is the “common language” between investors, portfolio managers and risk managers. However, this approach runs the risk of over-engineering and simply reframes the initial problem (Hawker, 2010). Optimizing portfolio’s with factors is conceptually related to the risk parity approach that has been developed in recent years.

Risk Parity. The idea behind risk parity is that a portfolio based on traditional asset allocation techniques may look roughly balanced from a capital allocation standpoint rather than from a risk perspective. For example, equities have contributed far more to total portfolio volatility than the equity allocation would suggest. Inker (2010) shows that for a 60% equity + 40% bonds portfolio, 90% of the volatility since 1973 could be attributed to equities. The solution to this disproportionate risk allocation to stocks is to reduce the weight of stocks according to risk parity and increase the weight of bonds, so that equities and bonds have a similar volatility impact on the portfolio. However, the overall volatility of the portfolio will drop. If the investor is comfortable with the initial

Approach 2: Factor Tilts



This means that the trustees of the pension fund follow the outlined steps.

- Determine the investment horizon, goals, and create basic ALM portfolio with SAA, TAA, or investment styles.
- Determine the set of factors to be used; map these factors on the existing asset classes.
- Check which factors are not in the investment universe or are underweighted, and check which inclusion improves the basis portfolio.
- Introduce factor biases within the assets. The fund starts out with the parent index and chooses stocks that exhibit the required characteristics.
 - For example, adding momentum as a factor requires selecting stocks with the highest cumulative returns of a particular stock for the previous 250 trading days. The portfolio is then reviewed and rebalanced on a monthly basis to keep exposure to the momentum factor. Smaller institutional investors could achieve the exposure by buying ETFs or funds that have been developed for this purpose, where the ETF or fund is constructed as a long-only investment sorted on the factor filter⁷.
 - Alternatively, complement assets with pure factors—these factors could be considered the “new” alternatives in asset allocation.
- Based on the outcome, establish benchmark (factor) portfolio and time horizon for evaluation and (re)balancing method.

⁷ Russel launched in 2011 a series of ETFs designed to capture this exposure for momentum, beta and volatility (<http://www.morningstar.com/cover/videocenter.aspx?id=385853>). So far, these funds have not attracted many inflows. Source: Do You Need a High Momentum ETF? by Zacks ETF Research, August 07, 2012. <http://www.zacks.com/stock/news/80552/>

volatility of the 60/40 portfolio, proponents of risk parity suggest that leverage should be used to achieve the required risk level. Overall, with the same risk level, average returns would have increased, with decreased risk. The risk-parity based portfolio construction process is agnostic in the sense that it balances the portfolio so that each asset class contributes the same potential for losses, so called risk parity. The base assumption of this risk parity is that an investor will always be paid, over the long term, for taking risks rather than holding cash. Pension funds can develop risk parity in a two-step process. First, the risk budget is allocated into four compartments (low or high economic growth and low or high inflation). Second, within each risk budget, asset classes are sub-allocated (also on an even basis), based on the exposure to the growth-inflation dimension. Here, the “purer” the asset class or strategy, preferably based on one factor premium, the more effective this approach is.

Pension funds increasingly adopt a matching-return approach. This investment model divides the portfolio into a matching portfolio based on fixed income instruments that partially or fully replicates the cash flows resulting from the pension liabilities. The return portfolio on the other hand takes investment risk to build up regulatory reserves and funds for indexation. Theoretically, the risk-parity model could be applicable in a matching-return approach, see for example Peters (2011) who argues that risk-parity yields better results for pension funds, even if liabilities are not taken into account when the portfolio is constructed.

The best-known pioneer of this approach is Ray Dalio’s Bridgewater hedge fund, which is based on the idea that a portfolio built on the allocation of risk should be more resistant to market downturns than a traditional portfolio. This is an appealing concept for pension funds and their trustees. Ben Inker, director of asset allocation at GMO, asks “what is not to like” in this approach, and singles out three criticisms (Inker, 2010). His main objection is that volatility and risk are not the same things that are incurred by an investor. For example, leverage allows investors to magnify return but also introduces path dependency. While an unlevered investor can wait for a process to converge certain valuations, a levered investor may not have this luxury. Levered investors cannot expect to maintain the same amount of leverage during high periods of volatility, being forced to reduce leverage and sell securities; risking forgoing positive future returns from overreaction and mean-reversion after financial distress periods. Another issue relates to the selection of factors. While risk parity suggests a valuation-neutral approach, it is not neutral and investors might end up leveraging risks that may not actually have positive returns associated with them. For example, the term-structure premium is a factor behind fixed income. A risk parity approach would significantly increase exposure to this factor, but does this make sense in today’s monetary

environment? Looking at a risk distribution pie chart does not give the investor information whether the portfolio is optimally diversified. For example, while country risk might be dealt with in the risk distribution, it still matters which country’s default risk is included. In other words, for pension funds considering analyzing the risk parity approach, a consideration is that risk parity improves the insight of the investor in the portfolio’s risks and sensitivity to scenario’s. On the other hand, in depth insight in the portfolio is still needed as well as knowledge of the (un)intended interaction between leverage and risk appetite.

4 Regulatory Perspectives

Summary

- Factor investing as an asset allocation approach is potentially a viable option for trustees to construct their portfolios as it agrees with from a regulatory perspective with prudent investor principles like diversification, transparency and lower costs.
- However, compared to the “traditional asset allocation” approaches hurdles have to be taken. For example, it requires more in-depth knowledge of investing and a more abstract perception from trustees about risk and return and for a number of factors the economic rationale is difficult to assess.
- This suggests that the risk due diligence and factor tilt approach to embed factor investing will be the main models for the years to come.

While institutional investors are developing different approaches to embed factor investing in the investment management process, the regulator’s view toward this development is crucial for a broader acceptance in the pension sector. Is factor investing an improvement for managing pension funds from a regulatory perspective? The literature review argued that factor investing might provide a more effective framework for trustees to fill in the “prudent investing concept” but also requires more knowledge and a different manner of decision-making from trustees. This extends to the whole investment management process that trustees have to oversee. Factor investing also blurs existing delineations between active and passive management, or alpha and beta, and thereby challenges existing knowledge.

A crucial assumption in a regulatory framework is that responsibility by fiduciaries, persons with the authority to make decisions regarding a pension plan’s assets⁸, is fulfilled prudently. For example, the uniform fiduciary standards of care in the United States stipulates among others that trustees “diversify assets to specific risk/return profile of clients” (Trone, Lynch, Rickloff, & Frommeyer, 2003). At the heart of most regulatory frameworks is the Prudent Investor Rule, a doctrine that provides guidance to investment managers regarding the standards for managing an investment portfolio in a professional manner. Prudent investing thus amounts to designing a governance structure and a process which one follows within the governance. If the process followed in making investment decisions is prudent based on what is known and not known at that time, then the subsequent decisions are prudent, regardless of the results⁹. There is no requirement, or expectation, that the fiduciary forecasts future returns. Rather, the fiduciary is required

to state the presumptions that are being used to model the probable outcomes of a given investment strategy (Trone et al., 2003, p. 22). In the Netherlands, prudent investing is closely aligned to the Modern Portfolio Theory (MPT) (see for example Maatman, 2004). MPT models a portfolio as a weighted combination of assets. By combining different assets whose returns are not perfectly positively correlated, MPT seeks to reduce the total variance of the portfolio return. So from a regulator’s point of view, the question is whether factor investing is a new way of applying the MPT, potentially improving outcomes. Research so far has mostly centered on identifying one or more individual factors. If however research literature on factor investing would gain traction and investigate its relation to the MPT more explicitly, it could over time provide a credible alternative way of implementing the portfolio management process, also from a regulator’s point of view.

Regulators already (un)knowingly play an important role in the acceptance of factor investing by increasing the risk-focused regulation approach. Part of this approach is that, for the risk budget allocated, regulators demand that an additional risk budget has to be maintained for active management, whereas in the past active management was considered to be risk-neutral. This will probably speed up a rethink of whether “classical” active management provides the additional value that is sought, another consideration for trustees.

Another question that matters from a fiduciary perspective is whether the trustee feels that he is in control with the investment strategy. A pension fund must organize its activities in such a way as to ensure that they are carried out in a controlled and sound manner. This involves identifying the risks and making sure that sufficient controls are in place¹⁰. The operations must be geared to the nature, scope, risks and complexity of the activities of the financial undertaking of the pension fund. How does this apply to factor investing?

⁸ DiBruno, 2006, p. 98.

⁹ <http://www.altruistfa.com/prudentinvestorrule.htm>

¹⁰ This can involve segregation of duties, policies, guidelines or administrative procedures. Controlled conduct comprises in any event: a clear and adequate organizational structure, a clear and adequate division of roles and responsibilities, adequate recording of rights and obligations, clear reporting lines, adequate system for the provision of information and for communication, the effectiveness of the structure of the organization and of the procedures and measures also have to be tested internally and independently. Taken from “Controlled conduct of business”, <http://www.toezicht.dnb.nl/en/2/51-202052.jsp>

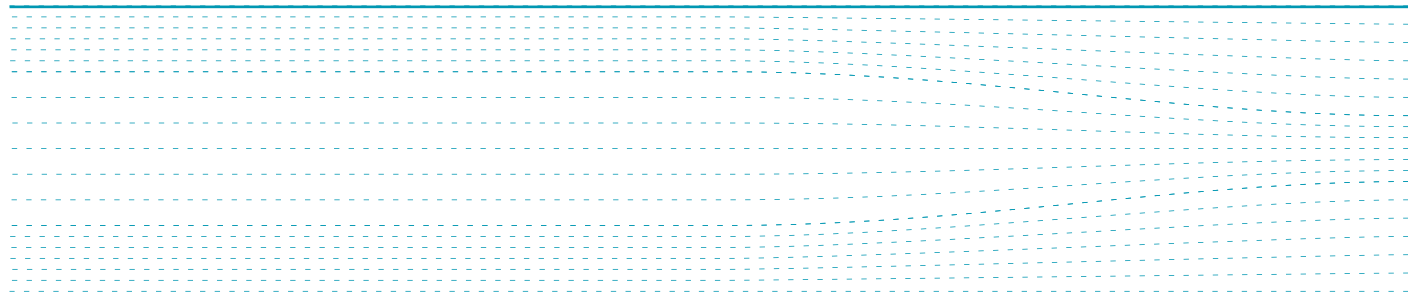
Factor investing could be viewed as an alternative strategy, distinguishing it from traditional investments such as the application of innovative financial products and derivatives, a greater reliance on the (portfolio construction) skill of the manager and the absence of a meaningful benchmark (IOPS, 2008). One of the principles outlines that “a pension fund is transparent in its communication with stakeholders about its policies regarding alternative investments and the objectives which it seeks to achieve in this respect.” This communication poses somewhat of a challenge for pension funds considering factor investing. After all, the current approach is to benchmark the investment manager who executes the strategy, allowing trustees as well as participants to evaluate the relative performance. The benchmark itself has to be transparent in its methodology. However, in general, broadly accepted benchmarks for factor-based strategies are limited to a few factors such as value or growth. For more novel factor premiums, such as minimum volatility, indices have been constructed, but their method of construction is not always transparent, which matters because some of these strategies and underlying indices might need frequent rebalancing. The alternative for trustees is then to resort to benchmark factor-based strategies against widely accepted, market capitalization weighted indices. This however leads to reporting and managing results with a large tracking error, depending on the choice of factors, which in turn is less desirable from the “in control” perspective. Overall, this suggests that factor based strategies are less applicable for pension funds who monitor the risk budget based on an asset allocation bandwidth and tracking error around a market capitalization weighted benchmark. On the other hand, it could be more suited for pension funds who evaluate the added value from a balance sheet perspective and place less emphasis on a tracking error, but this requires intensive and transparent communication with its stakeholders. Applying this manner of evaluation is still work in progress though. For example, several Dutch pension funds have over the years developed a balance sheet approach. Solvency management, which applies a top-down balance sheet approach to manage the pension fund, is then separated from managing investment strategies. Despite the financial success of this approach, a limited number of pension funds seem to have adopted this approach, suggesting organizational and cultural hurdles to be taken.

While factor investing has the potential to change the decision-making and asset-allocation process of pension funds, it also has the potential to alter the face of the investment management landscape if it would really take off. The starting point for interest in factor investing in recent years was, after all, the Ang, Goetzmann & Schaeffer (2009) study, commissioned to investigate why active returns of the Norway Global Fund were disappointing. A major finding was that a large share of active

returns could be attributed to systematic factors. Therefore, it is only fair that pension funds ask themselves what the role of active management is, if the managers apply factors in a systematic way for a higher fee that the pension fund could replicate and implement itself for a lower fee. This is also relevant because transparency in costs has been on the agenda of trustees in recent years. Following this line of reasoning, pension funds will have to develop a new approach towards active management. They will embed specific factors that were previously the domain of active management into their (strategic) asset allocation at a far lower cost with probably similar results. When they choose active managers, these managers will be stripped as much as possible from earning returns based on systematic factors and have to differentiate investment strategies/ styles that cannot be replicated in strategic asset allocation – the high conviction/active share view. Factor investing could therefore be viewed as an effective response to the calls by stakeholders, politicians and regulators to provide more transparency about investment costs, and where these costs could be lowered.

Factor investing as an asset allocation approach and its potential effects on investment management styles and costs are questions that trustees do not deal with on a regular basis and require a lot of governance resources. This suggests that factor investing might not be something that pension funds with smaller resources or staff would easily consider. After all, the outcomes in portfolio construction could differ significantly, as well as the (daily) monitoring and rebalancing. So far the mainstream portfolio allocation methods are based on mean-variance optimization methods, a framework used to spread the portfolio across different assets by assessing the trade-off between risk and return for maximum return while minimizing any risks. Implementing factor investing however, combines two steps: unbundling the assets in different factor premiums and potentially allowing alternative portfolio-allocation methods to further enhance the diversification benefits when investors target their specific investment preferences.

Another concern for regulators would be that the shift from assets to factors in the investment decision process requires that trustees and decision-makers in pension funds should familiarize themselves with, and perhaps even decide upon, the portfolio allocation method. The allocation of factors needs to be more risk-based, and there is not yet a consensus what would be the best method to choose. An equally weighted factors (the 1/N) approach in the portfolio is generally a good starting point, but optimizing an equally weighted portfolio appears to be an awarding approach (Koedijk, Slager & Stork, 2013, p. 29). The choice of method depends on the understanding by the decision makers of the advantages and disadvantages of the portfolio allocation methods.



For example, an important consideration is whether to develop a “rules based” portfolio method, preventing strongly concentrated factor weightings, and making use of any “mean-reversion” effect that may be present. On the other hand, a rules-based method assumes that the investor does not possess any useful information about the factors in the portfolio. Available information can be valuable, but the generation and use is also subject to behavioral biases. The choice of method requires understanding by decision makers of these considerations.

5 Conclusions and Checklist to Implement Factor Investing

Summary

- Factor investing is an existing portfolio management concept developed in the late seventies, and has been revived as a promising avenue for portfolio construction, providing a framework to improve diversification as well as analyzing active returns, improving the selection and monitoring process. However, more work needs to be done on the persistence and rationality of these factors, and what it means for the decision making process of trustees.
- We condense the findings from the literature review and case studies in a checklist of eight key points.

5.1 Conclusions

Is factor investing on the verge of a takeoff? Interest in factor investing in recent years started with the Ang, Goetzmann & Schaeffer (2009) study, commissioned to investigate why active returns of the Norway Global Fund were disappointing. A major finding was that a large share of active returns could be attributed to systematic factors, so it is only fair that pension funds ask themselves what the role of active management is. Do the managers apply factors in a systematic way for a large fee, which the pension fund could easily replicate and implement itself for a small fee?

Asset returns can be attributed to a few underlying explicit factors such as macro-economic factors, firm attributes or style factors, with these factors representing sources of systematic risk and return. The factor approach aims at providing a relatively precisely defined exposure to factors that may explain differences in asset returns or, to a large degree, the excess returns of actively managed portfolios. This creates the opportunity to construct portfolios with assets based on the knowledge of underlying factors, or even design portfolios with factors rather than with assets. This paper surveyed various types of factor premiums that appeal to different investors, depending on economic rationales, time horizons and risk preferences. Three types of implementing factors in the investment management process were identified. These are

1. risk due diligence, checking for unwanted concentrations or lack of factors,
2. applying factor tilts, by overweighting factors within the asset allocation or adding factor to the existing asset allocation (which we labeled as suppletion), and
3. factor optimization, whereby the portfolio is bottom up constructed, solely with the use of factors.

These approaches have in common that they uphold the central tenets of portfolio management such as diversification in combination with seeking premiums that are expected to reward the investor for incurred risk. We also found that the risk due diligence approach is gaining

broad acceptance, as well as the factor tilt approach. Several large funds were already applying such an approach before it was renamed factor investing. The advantage however is that with the new research literature more tools are provided to the investor to better embed it in the investment process. Finally, the factor optimization approach is as yet rarely applied.

The literature study and the case studies yield a checklist for pension fund trustees considering investing, or expanding more into factor investing. Some of the issues are practical in nature to consider. The case studies in the next chapter will show that factor investing has been an existing concept since the 1970s, and mainly (implicitly) implemented through the investment styles once the strategic asset allocation was determined. Factor investing has been an implicit investment belief, embedded in statements like “we think that there are a limited number of factors driving diversification”, or “Market capitalization weighted indices are not the best way to gain systematic exposure to factor premiums”. Factor investing can provide a tool to further investigate these claims and define consequences for the portfolio management process. The case studies will also show that the development of factor investing as part of an investment management framework can lead to different applications. For PGGM and ATP, the main advantage lies in portfolio construction itself, trying to create more robust portfolios. Blue Sky Group, with a stronger focus on selecting and monitoring external mandates, also views factor investing as a tool to scrutinize active mandates, separating systematic risk factors from skill. Combined with new insights on active share, this might lead to a new core-satellite approach for pension funds.

There are many technicalities to consider, however. To determine the scope of factor investing, the statistical relevance of factor premiums has been researched and shown for a large group of factors. But other issues pose trustees with more challenging questions. For example, the economical reasoning behind it is not always clear. This matters for the persistence of these premiums in the investment process, but also from a trustee’s point of view: he has to provide the arguments behind the investment choices. Finally, we touched upon the regulator’s role in factor investing.

On the one hand the risk based approach and focus on costs and transparency could boost the acceptance and application of factor investing with pension funds, central to the prudent investor tenet. On the other hand, the investment style increases the demands on investment governance, since portfolio construction and maintenance changes require more knowledge, pro-active monitoring and active decisions from trustees. Finding the right balance between these sides will determine the

success of factor investing in the pension industry.

5.2 Checklist to implement and monitor factor investing

What should trustees consider before deciding that factor investing is the way forward? Before we describe the cases in the final chapter, we put forward a checklist with eight key points for pension funds and other seasoned investors. These key points are not only based on the literature review, but also on the analysis of cases involved.

1. Treat factor investing as an investment belief

Risking to state the obvious, an institutional investor should first determine if factor investing is the right thing for the fund's investment strategy. After all, factor investing is (partially) redesigning diversification. If the current diversification approach works for the fund, that's fine. If however the fund aims to steer more explicitly on the factor premiums behind diversification, factor investing makes investment sense. There is an increasing amount of research available, yet there are many issues still unknown or uncertain that need to be addressed. Factor investing requires a thorough understanding of the funds' goals. The fund could implement factor investing to achieve maximum diversification or to improve the expected return given the existing risk profile. The cautious investor might consider the risk-monitoring approach; more staunch adapters with a feel for innovation could consider the factor tilt approach.

2. Determine what the investment managers are talking about

There is common language to consider. When implementing factor investing, the institutional investor has to reframe the terms to be used. Confusion needs to be avoided, especially with terms like "smart beta". When working with trustees, a definition list to sort out active-passive, beta-alpha, etc. comes in handy.

3. Be consequential

Working with factors takes out the systematic beta component that active managers use or present as alpha. It does not make sense to base the core portfolio on factors and not ask whether the active mandates have similar factors behind their returns.

4. Focus on benchmark construction

More research and thought needs to go into this subject, as it is crucial for implementation. Any choice of alternative indices, or factors representing these indices, forms an explicit choice not to include other factors. How do you construct a benchmark that provides you with the right exposure? Furthermore, if the benchmark is customized, trustees should determine how they evaluate the performance of the customized benchmark against the default scenario (or base mix), as well as how to rebalance the

benchmark and portfolio, taking into account turnover and transaction costs.

5. Educate your pension fund stakeholders

Trustees, investment committees of pension funds and investment professionals should be able to understand factors before they agree to apply them in the portfolio. It is vital that board members understand what investors are doing, and remain in control of the investment process. But some factor strategies are easier understood than others. Factors with a fundamental economic rationale, for instance value, can be adopted and communicated as investment beliefs and then approved as strategies. But if the fund would propose a risk-efficient index, the complexity might be a struggle for many trustees to grasp.

6. Regularly review the economic rationale and relevance of factors

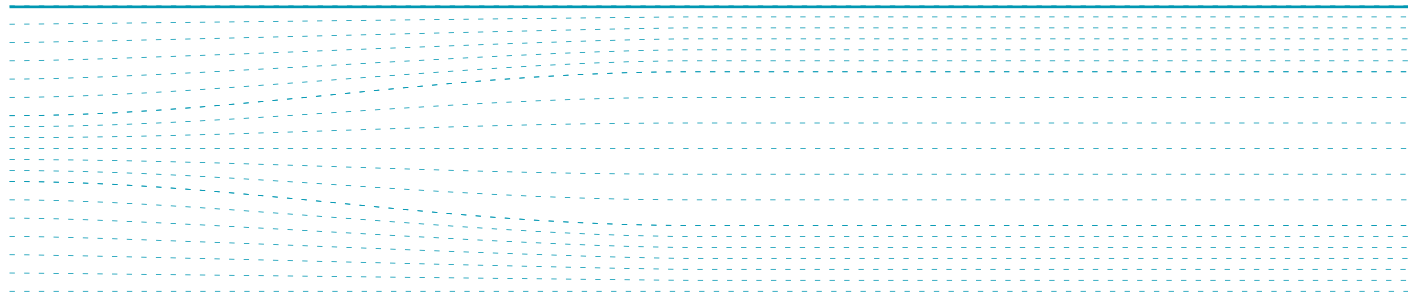
Anson (2005) quotes several authors who provide examples of investment management strategies that had once been considered manager skills (i.e., alpha) but are now regarded as a systematic capturing of current risk premiums or beta, and potentially decrease as systematic factors are excluded from alpha. This suggests that strategies go through cycles, sometimes in favor, sometimes out of favor. A number of factors have been well researched, giving more insight as to when they are in or out of favor. This especially applies to classical factors such as size, value/growth, or momentum. Van Gelderen and Huij (2013) show that the best researched factors who show few ambiguities in the research findings, tend to produce the best outcomes.

7. Take an active stance on active choices

Factor investing requires business intelligence. After all, the cap-weighted index is not the sum of the alternative indices, as these are only a small part of the universe underlying the cap-weighted index. The market value of a stock can be subject to all kinds of biases like home bias, large-cap bias, liquidity constraints, preference for high-beta stocks, et cetera. Another active choice is the use of forward-looking risk factors; it can reduce hindsight bias and the risk of concentration in assets that are not likely to repeat their performance (Bhansali, 2011). Forward-looking indicators require a feeling for valuations, however. Minimum Variance Funds have gained popularity over the past years, coinciding with (and even perhaps the cause of) rising valuations of companies that are popularly held in minimum-variance funds. If such strategies are trading at peak valuations, harvesting the factor premium in the short-to-medium term might be difficult (Fraser-Jenkins, 2012). Similar reasoning applies to the emerging markets premium (Authers, 2013).

8. Decide if the allocation of factors is going to be static or dynamic

Rebalancing is a potential deal breaker for implementation. The more



risk-based the factor allocation is, the larger the need for regular rebalancing activities can be. For the allocation to factors on a static basis with a longer investment horizon, such as the asset class factors and some of the style factors, rebalancing has to be thought out carefully. If they are dynamic with a shorter investment horizon, to what decision variables should they be linked?

6 Case Studies

Summary

- Four case studies are presented to investigate how funds implement factor investing.
- PGGM and Blue Sky Group have applied factor tilts in their portfolio construction over the last years. Both organizations find added value in the robust portfolio construction approach. Blue Sky Group monitors the risk factor exposures of the active equity mandates.
- Danish ATP chooses an implementation path between factor tilts and factor optimization.
- Finally, factor investing for a smaller pension fund or endowment is considered. Using factors as a risk due diligence seems to work best.

We conducted a study of a selection of pension funds that have implemented one or more elements of factor investing: Dutch pension administrators PGGM and Blue Sky Group, and Danish ATP. These three cases concern large organizations; we therefore added a fourth case to consider the implementation of factor investing for a small pension fund. Each case study identifies the challenges the organization faced or faces, and the strategy that it subsequently developed. Lessons learned are formulated, which provide the basis for the checklist presented earlier when considering factor investing.

6.1 PGGM

Background. In 2006 PGGM changed its investment process for its pension fund and added strategies to earn factor premiums more explicitly than in the years before. A reassessment of the advantages of being a long-term investor, as well as increased demand for short-term balance sheet management had led to new demands by trustees. PGGM has shown itself to be an early adopter of portfolio-management techniques; its investment process is an apt example of the factor tilt approach through suppletion/alternative indexing to implement factor investing.

Challenge. PGGM is the pension administrator for the Dutch Pension Fund for Healthcare ‘Zorg en Welzijn’ (PfZW), serving a handful of other pension funds as well. PfZW is the largest client of PGGM, and provides a compulsory collective pension scheme for the healthcare and welfare sector. With EUR 130 billion of assets under management for 2.5 million current and former participants, it is also one of the largest funds in Europe. PfZW invests the contributions paid by participants and employees with the aim of achieving a high, stable and responsible return on investments over the long term at an acceptable level of risk¹¹. In the 1990s it significantly broadened its diversification, pioneering with new ALM techniques, investing in commodities, private equity and emerging markets at an early stage. After the dot-com crisis in 2000,

PGGM observed that these efforts to improve diversification were below expectations. Dutch pension funds also had an additional challenge – a regulatory framework was developed to commence in 2006, aiming at the market consistent valuation of the liabilities and risk-based reserves. This regulatory framework had a short-term horizon, while diversification was hitherto treated as an instrument for the long term. The Board of Trustees set out to combine these horizons into its goals, a continuing drive to earn stable and high returns.

Strategy. Today’s investment process is the outcome of a longer existing process and was designed over a number of years to accommodate the main decisions that trustees have to take, as well as developing well defined roles for the board and pension delivery organization. In the beginning of 2005, PGGM started to adopt a new investment strategy called the portfolio of strategies. The foundation of this portfolio is the idea of obtaining a structural return based on different strategies rather than the classic buy-and-hold strategy, exploiting the advantages a large pension fund has in the financial markets. The thought process of embedding the portfolio of strategies was a driving factor of developing PGGM’s investment process, which today consists of three steps (Figure 4). The first step defines how the aims of the pension fund are translated into financial goals and restrictions. Internally known as the “basismix” (base mix), the main choices here are the level of risk appetite, defined by the share of matching and return in the portfolio. This base mix has all the characteristics of an implementable portfolio but on a high-level approach. The process starts out with meeting the pension liabilities. It then improves on the portfolio’s absolute risk and return profile. Finally, it executes the actual investments.

Asset and Liability Management. The first step is to determine the policy portfolio (base mix), which reflects the risk appetite of the fund over the investment cycle, and structures the investments to meet pension liabilities. It provides a rudimentary asset allocation, hedging strategy and other investment rules. Portfolios and investments are not clustered in specific categories but treated as one portfolio¹². While this portfolio is not implementable as such, it helps trustees in their decision-making. In terms of risk-appetite, all secondary decisions have been stripped in this step, focusing the discussion. Moreover, the portfolio provides a reference point upon which the pension fund and pension delivery organization can base its investment construction choices.

¹¹ PfZW, 2013. An Insight into Pensioenfondsen Zorg en Welzijn. http://www.pfzw.nl/about-us/Documents/PFZW_Jaarbericht_UK_2012_3.pdf

¹² Similar to Canada Pension Plan, see Raymond (2009).

The Three-Stage Investment Process Applied by PGGM

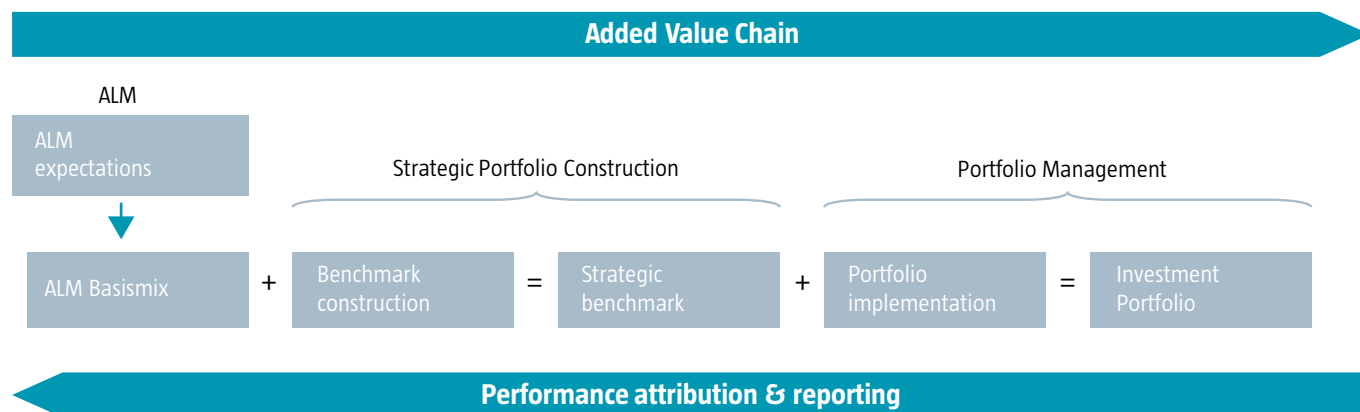


Figure 4. The Three-Stage Investment Process Applied by PGGM

The Reference Portfolio. The second step zooms in on the investment policy. The goal of the strategic portfolio construction is to create a reference portfolio, which is supposed to yield a higher return against lower risk than the results described in the first step. The base mix and the constructed reference portfolio (benchmark) together form the strategic (or policy) benchmark (SBM). The SBM aims to deliver a more stable and higher-net return versus the pension liabilities over the cycle than the base mix. A more stable return should be realized by a combination of (1) a lower absolute risk, (2) a relatively lower liability risk, and (3) a smaller drawdown under stress. This should all be shown ex-ante and delivered ex-post.

PGGM considers three elements during this second step. The first is diversifying its assets among different investment categories¹³. Because of the high amount of invested funds and the long term in which the pension fund can invest, it has the possibility of investing in strategies and factor premiums that are not accessible to other institutional investors. The second element is gaining a broad exposure to the asset categories, to create the best fit with the fund's portfolio and investment policy. Taking market conditions and medium-term valuations into account, attractively priced investments are prioritized over less appealing priced investments, also providing a framework to adapt the portfolio in the case of extreme market circumstances.

The third step encompasses the investable portfolio and implementation. The SBM from the previous step is used to create the investment portfolio

whereby assets are differentiated in liquid and illiquid investments. The allocation of liquid investments will be in line with the relevant strategic benchmark. The emphasis is on efficiency and costs. The allocation of illiquid investment strategies on the other hand, such as private real estate, infrastructure, and structured credits is generally less suited for benchmark comparison.

The result of the value-added chain is shown in Figure 5. The ALM determines the maximum acceptable risk and the minimal acceptable return (point 1). The second step ought to create an SBM with lower risk and higher return than the ALM base mix, i.e., a better beta portfolio (point 2). Finally, the actual portfolio (step 3) should capture an attractive alpha, improving returns and risk relative to the reference portfolio.

Better Beta Strategies. In the beginning of 2005, PGGM started to implement 3% of then PGGM's assets to the portfolio of strategies (PGGM, 2006). The idea behind Better Beta is to yield a structural higher return against lower risks compared to the ALM, based on different strategies than the classic buy-and-hold strategy. The central goal was to achieve a stable, absolute return. The value factor was implemented into this new portfolio. In 2007, the Low Volatility factor strategy was added to the portfolio. As of 2013, 40% of the allocation to listed equities is now allocated to a combination of three "better beta" strategies: value, minimum volatility and quality. Recent innovations in the portfolio have placed more emphasis on interest- and inflation hedging.

¹³ Pensioenfond's Zorg & Welzijn, 2013. Annual Report.

The Three-Step, Value-Added Chain, Implemented in Total Risk/Return Opportunity Sets (Van Dam, 2012)

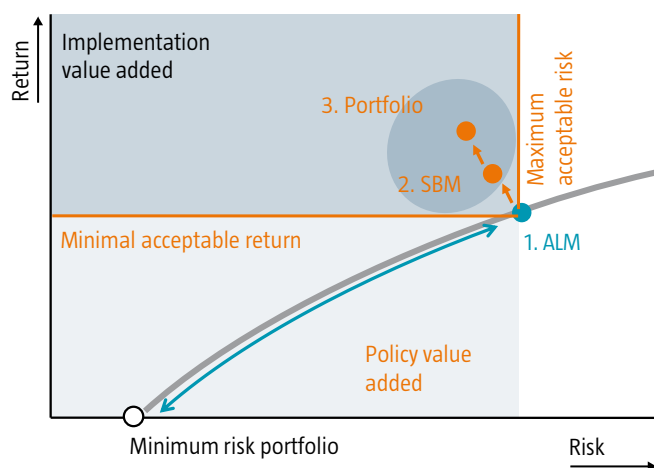


Figure 5. The Three-Step, Value-Added Chain, Implemented in Total Risk/Return Opportunity Sets (Van Dam, 2012).

Interaction with the checklist

- A well-designed investment policy plays a central role when a pension fund undergoes a transformation. Successful implementation is a process of continually shaping and adapting while keeping the eye on the ball (see checklist #4).
- The question is where to position factor allocation choices in the investment process. Factors with a longer-term horizon should be placed higher up in the investment hierarchy, (see checklist #6, #8).
- Financial markets adapt, and so do the insights in factors. Despite the positive results over the last couple of years, PFZW is far from done exploring alternative betas. According to Jaap van Dam, the Managing Director Strategy at PGGM, a new generation of investment products is coming. He points out however that we do not yet understand the underlying causes of its performance. Only if we understand these processes can we start implementing the next generation of alternative investments. This process can take years¹⁴ (see for checklist #1, #5, #7).

¹⁴ Maaïke Veen (2012). “Alternative Beta is voor beleggers met lange horizon”, interview met Jaap van Dam. Financial Investigator, Nummer 6, p. 38-39. http://www.financialinvestigator.nl/core/projects/90/user_files/records/87/42/FI-6_P38-39-def.pdf

6.2 BLUE SKY GROUP

Background. Blue Sky Group (BSG) is the fiduciary asset manager for the Royal Dutch Airlines (KLM) Airlines pension funds. One of the distinguishing features of these pension funds is their approach to risk perception and management, which draws on the experiences in the transport sector.

Challenge. How can a fiduciary asset manager that outsources most of its investments, embed the developing insights into smart beta and factor investing in a cost efficient way that improves the investment process and by inference ex-ante the pension fund clients’ results? BSG has a long-standing tradition of in-house research, which contributes to their ability to react on developments at an early stage. As one of the more sophisticated Dutch pension funds, their investment process is “evidence-based”. For example, their interest in fundamental indexation dates back to prior to 2009 when it was first systematically researched for the pension fund board, as were low volatility strategies and alternative beta equity strategies in 2011. Research efforts were translated into investments in 2011, with an allocation to defensive equity strategies (Hollander & Tol, 2012). The majority of their assets are outsourced. 40 percent of BSG’s equity exposure is focused on passive products, and the remaining 60 percent is managed actively¹⁵. ‘A core-satellite approach used to be in place, where investment strategies in markets that BSG considered to be efficient were either index replicating or enhanced-index. This approach has changed however. The composition of active and passive has changed in recent years. BSG moved from enhanced indexing mandates to combining passive and “high octane active ones” because these tend to have a better outperformance potential in the long run. These ‘high octane’ mandates now make up 20% of the active equity exposure and are the result of a shift in strategy triggered in part by lagging performance of enhanced indexing strategies, and in part by academia. Some low tracking error enhancing index managers showed disappointing results, while simultaneously new research was emerging to show that higher octane managers tend to be more consistent outperformers than lower tracking error managers. Triggered by insights from among others, Cremers and Petajisto (2009), active managers in efficient markets can be selected, albeit with a “high octane” character, i.e., high conviction and a large active share.

¹⁵ Simpson, Atholl, 2012. In search of high octane managers. Citywire Global, <http://citywireglobal.com/news/in-search-of-high-octane-managers/a584614>

Strategy. This research-driven approach also guides implementation. The investment committee approved (or advised trustees to approve) an allocation of 10% of the equities portfolio to low-volatility strategies. This was implemented in two steps. First, 5% was allocated in the next six months to build up experience and comfort, feeling that the (implementation of the) strategy was consistent. After six months the investment committee commissioned an update of the research to see if any new insights were developed, and based on this information, allocated an additional 10% to a total of 15% of the equity portfolio. In terms of decision-making, from the moment that the committee was advised on this strategy to the actual decision to implement the strategy, took about six months. The main focus is the equity portfolio; BSG has not yet ventured to expand the approach to other asset classes. An important reason is that research on factor investing for other assets is relatively scarce.

These factor-investing developments are very much part of a liability-driven investment approach. While the discussion has started with a low-volatility strategy, BSG might consider this as just one building block in the factor-based investing approach, since there are more options. For low volatility, reduction of equity volatility is achieved while upholding expected returns, thereby reducing the volatility of the solvency ratio. This in turn generates better risk-adjusted returns in the long run. The regulatory framework however provides disincentives. While there is evidence to show that a low-volatility strategy with equities has historically reduced the downside risk, pension funds still have to apply the full-equity charge in calculation of required reserves when implementing a low-volatility strategy.

Factor investing is also a route to explore cost transparency in the coming years. A major finding of the Norway study was that a large share of active returns could be attributed to systematic factors, so it is only fair that pension funds scrutinize the role of active management strategies. Do managers apply factors in a systematic way for a large fee, which the pension fund could easily replicate and implement itself for a small fee? This is especially relevant in the Netherlands because transparency in costs has been a priority on the agenda of trustees in recent years.

Following this line of reasoning, pension funds might well develop a new approach towards active management. They will embed specific factors that were previously the domain of active management into their (strategic) asset allocation at a far lower cost, with similar results. When

they choose active managers, these managers are stripped as much as possible from earning returns based on systematic factors and have to differentiate investment strategies/styles that cannot be replicated in strategic asset allocation – the high conviction / active share view. BSG will further analyze its equity portfolios where the portfolios are decomposed in factors. A number of factors should be expected, given the choice in investment styles, but the interesting part is to see whether unexpected factors show up, if there is a concentration of factors that BSG was not aware of, and if there are factors that BSG could replicate more cost-effectively outside the existing mandates. It might well be the start of a thought process that could lead to a redesign of the equity portfolio.

Interaction with the checklist

- Factor investing is a relatively new approach and requires time and effort from the funds' governance resources (see for example checklist #6, #7).
- Draw investment committee and trustees early into the discussion. BSG implemented the strategy in steps, building in evaluation moments at an early stage for a learning curve by introducing an evaluation early on (see for example checklist #2, #5).
- Factor investing could help trustees achieve similar results when cost transparency becomes key (see for example checklist #3, #4).

6.3 ATP

Background. ATP has been a leader among Danish pension institutions in adopting innovative investment policies, diversifying internationally, increasing the interest rate sensitivity of its assets and, more recently, expanding the use of long-dated interest-rate swaps to hedge its pension liabilities. It has used an effective system of risk sharing with both active and passive workers, offering minimum guaranteed benefits and annual bonuses that depend on both investment returns and longevity trends (Vittas, 2008).

Challenge. ATP builds up retirement income for the vast majority of Danes with the ATP Livslang Pension (Lifelong Pension) scheme, to which both employees and employers have paid contributions. With total assets worth more than DKK 600 bln (EUR 80 bln). ATP ranks among the largest pension investors in Europe. More than 4.7 million Danes save for a supplement to their pension via ATP¹⁶.

ATP has been an early adopter of factor investing. The CIO Henrik Gade Jepsen argues that risk parity alone cannot do the trick of maximizing

¹⁶ http://www.atp.dk/wps/wcm/connect/ATP/atp.com/about/omatp/about_the_organisation/about_ATP/

risk-adjusted returns and minimizing the risk of large draw downs (Jepsen, 2011).

Strategy. The fund has implemented the approach since 2006. The investment portfolio is constructed to generate a return that is sufficient to increase pensions in line with inflation as well as cover provisions to finance life-expectancy increases. In terms of risk appetite, drawdown risk should be low, because heavy losses would make it difficult to bear investment risks and thus affect the ability to deliver sufficient returns in the future. The challenge, as with many funds, is to maximize risk-adjusted returns while minimizing the risk of large investment losses and realizing this in an environment where financial regime shifts and extreme events characterized by fat tails. Jepsen (2011) describes the investment process as follows:

1. Portfolio construction is based on a risk parity approach, spreading risk more or less evenly among risk factors to generate higher risk-adjusted returns than equity-based portfolios, and obtain the most effective diversification. Allocating risk instead of assets is to prevent a single asset class (or risk factor) dominating the portfolio return because of the way the underlying investment is structured.

A risk factor approach for the entire portfolio enables ATP to focus on the most important return drivers and avoid spending time on less relevant investment discussions.

2. Construct the portfolio with five risk classes that reflect different underlying economic risk factors, which are different determinants for return. The focus on these risk classes does not mean that ATP manages the portfolios passively; within each risk class, the exposure to other “secondary” risk factors are managed as well. The risk classes are

- Interest-rate (interest-rate sensitive bonds)
- Credit risk (ability of issuers to repay obligations)
- Equity risk (corporate earnings)
- Inflation risk (general price developments)
- Commodity risk (oil prices)

3. All uncompensated risks are hedged to generate the highest possible risk-adjusted returns. For ATP, the main uncompensated risk is the interest-rate risk on pension liabilities. Hedging takes place through a separate portfolio consisting of interest-rate swaps and government bonds.

4. Hedge tail risks. These so-called tail risks take the shape of sharp drops in the investment portfolio. According to Jepsen, “Tail-risk protection also makes leverage an acceptable way to balance risks in the portfolio as the potential larger losses from leveraging can be eliminated by buying downside protection.”

5. Develop a last line of defense. Risk weighting is explicitly formulated in a dynamic rule to ensure that sudden losses do not further weaken the solvency ratio. The dynamic rule defines a risk budget based on ATP’s reserves. Major losses result in active divestment, while strong returns produce an opposite result to ensure that the risk does not exceed the set budget.

Interaction with the checklist

- Factor investing need not be implemented at a single strategy level, it also plays at a higher level. The basic challenge of diversification is to combine assets with as many different profiles as possible, with a sensible economic rationale (see for example checklist #4, #6).
- Having a risk factor approach for the entire portfolio enables decision makers to focus on the most important return drivers and avoid spending time on less relevant investment discussions (see for example checklist #5).
- Furthermore, the investment management process of ATP could be considered as a two-way approach. Diversification is a useful concept for the long term, but inadequate to manage solvency in the short term. Hence the last line of defense approach (see for example checklist #3).

6.4 Small Pension Fund and High Net Worth Individuals

Is factor investing the exclusive domain of large institutional investors, or is the model also applicable to smaller pension funds¹⁷, endowments or high net worth individuals? This question is closely related to the question whether the investment governance for a small investment organization is materially different than for a large one. “The most important thing for the governing fiduciaries of small funds to realize is that they are subject to the same principles of pension economics, capital markets and investment management services markets [as large funds]” (Ambachtsheer & Ezra, 1998, p. 150).

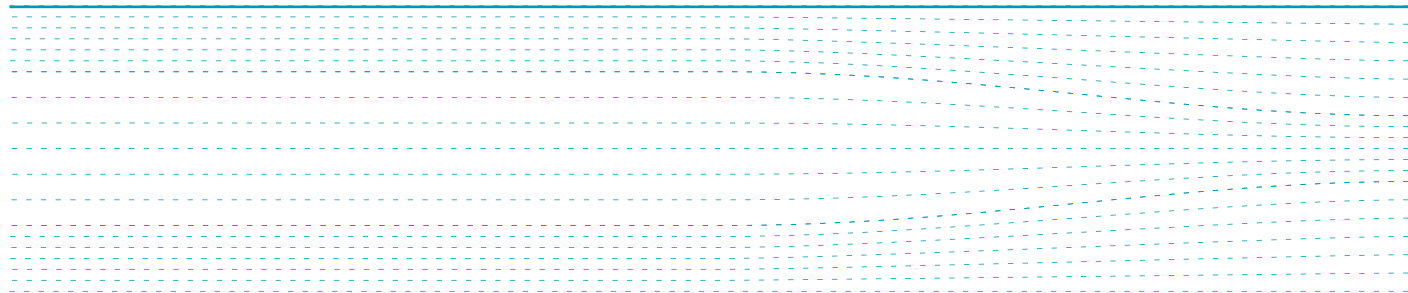
¹⁷ For the Dutch pension schemes, there is no generally accepted definition what constitutes a “small” pension fund. A delineation could be pension scheme with less than 1 billion euro in assets. End 2012, 311 pension funds of the 387 could be classified as small. This is anecdotally supported by the AFM, who reports that a decrease of costs is strongest for funds up to 1 billion euros (AFM, 2011).

Smaller funds do however have to work within the constraints of diseconomies of scale: less resources for a full time staff, a higher dependency on (investment) consultancy for portfolio construction and monitoring, and higher costs when outsourcing investment management services such as portfolio management or custody. Ambachtsheer and Ezra (1998) warn that trustees of smaller pension funds tend to ignore this reality 'It is common practice for small fund fiduciaries to try to "part-time" their way to success' by choosing to do the same range of activities as for large pension funds. Decision makers therefore have to think through what really matters to achieve their goals. Ambachtsheer and Ezra (1998) emphasize that a smaller pension fund should not try to overcompensate, but work within the limits of its size and organization. This applies for example when a small pension fund is considering to implement factor investing.

- Is the pension fund clear about the added value of factor investing in the investment process? This question also applies to large pension funds, but smaller funds have to deploy their relative scarce resources more carefully. Can it define the investment process, the decisions to be made and which steps add value? Also, are the decisions aligned to the monitoring frequency of the investment committee or staff? When a pension fund has an investment process with a low frequency of rebalancing, the choice of factors should be focused to those that are less volatile in a portfolio context, or require less intensive monitoring because the strategies are well documented. This restriction does not limit the potential return/risk improvement of investment strategies, however. Van Gelderen and Huij (2013) show that the best-researched factors with few ambiguities in the research findings tend to produce the best outcomes.
- Does it help to drive down costs and profit from economies of scale? Has the investment committee taken all steps within the investment management process to lower costs? An effective way to lower costs is to implement the factor investing strategy passively and limit turnover to a (simple but effective) rules based rebalancing strategy.
- Does it have thorough knowledge of the capital markets, products and instruments? A smaller pension fund is generally a price-taker, with few opportunities to negotiate lower fees or invest in knowledge and information systems. The committee should be aware what sort of role its fund and asset manager can play in these circumstances. This limits the factor investing strategies to the selection of a few liquid instruments.

Smaller pension funds have to deal with these investment governance issues when deciding to implement factor investing. Managers of portfolios where the involvement of the client is stronger, such as small endowments or portfolios of high net worth individuals in private banking, have to consider additional issues:

- Investing with factors is a more abstract investment process. Clients can relate to equities, bonds and real estate. While this helps the financial advisor in the discussion with the client to establish the asset allocation, it is also prone to biases, like availability. Factors on the other hand are implemented through instruments that are not easily recognized. This is a more abstract process that requires a more thorough intake and discussion with the client. When establishing the risk appetite of a client and portfolio, the client has no real reference points compared to the regular portfolio construction process. Pension fund trustees on the other hand are more accustomed to consider and work with risk measures in an abstract return/risk framework.
- Private clients have a more dynamic investment style than institutional investors. Clients have different degrees of aversion to different types of risk (Kahneman & Riepe, 1998; Ackert & Deaves, 2010, Chapter 18). When markets go down, they focus more on capital preservation. When markets rise, clients aim to profit from the upside. Pension funds on the other hand generally have an asset allocation strategy that is designed to weather upside and down markets, and has more tolerance for downside movements built in than individual investors would find acceptable. The consequence is that when individual clients invest in factors, a more forward looking factor allocation is needed (Bhansali, 2011b), requiring a dynamic allocation approach for factors. This area has been less researched in academia.
- The behavioral finance literature has developed to understand individual behavior, financial decision making, incorporating aspects of human psychology (see Ackert & Deaves, 2010 for an overview). One relevant aspect here is that individual investors tend to assess investments on a stand-alone basis, which can lead to a sub-optimal use of diversification benefits. It is therefore more important to view factor allocation from a total portfolio context instead of viewing factors separately, to encourage clients to take as broad a frame as possible to take investment decisions (Kahneman & Riepe, 1998).

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- Financial advisors have to redevelop their performance measurement and quarterly reporting approach, redefining their relationship with the client. The traditional approach is to frame the portfolio performance within a context of macro-economic, political and social developments. This is information which is easily processed, as more likely to be viewed as true (Ackert & Deaves, 2009, p. 86). Factor investing however involves assessing difficult information, leading to an information overload if it is not presented in the right way.

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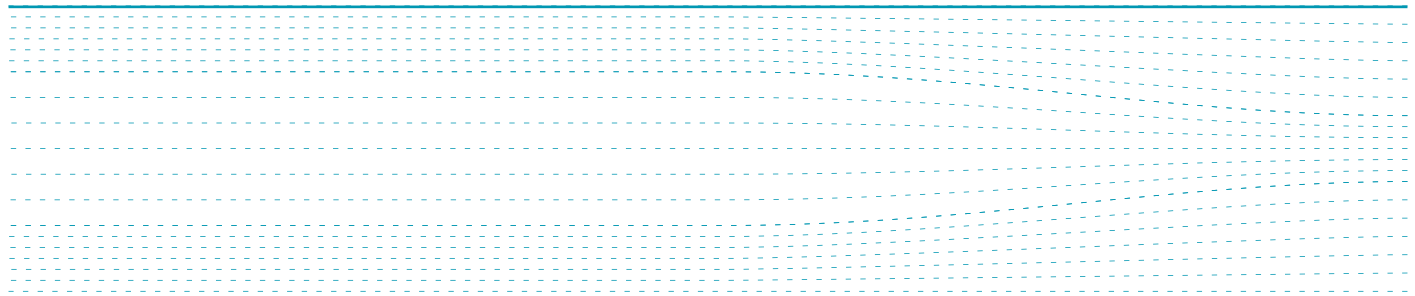
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Appendix. Existing Research on Main Factors

	Factor Found In	Economic Rationale	Application	Research
Asset Factors				
Equity, Fixed Income, Currency	Broad Markets	Compensation in excess of the risk-free rate on a passive investment in a traditional broad source of risk		
Inflation	Equity, Bonds, Currency, Commodities	Measure for cost of living	Euro inflation-linked bonds minus nominal government bonds: TIPS in the U.S., Inflation swaps	Elton, Gruber and Blake, 1995; Derwall, Huij and De Zwart, 2009
Economic Growth	Equity, Commodities			Callan, 2012; Peter, 2008
Style Factors				
Value	Equity, Bonds, Currency, Commodities	Compensation for purchasing equity below its intrinsic value, and the time horizon needed before valuations reverted to the mean	High book value to market value stocks	Fama and French, 1993; Carhart, 1997
Growth	Equity, Bonds, Currency, Commodities	The purchase of stocks that have high-expected future growth rates		Fama and French, 1993; Carhart, 1997.
Momentum	Equity, Bonds, Currency, Commodities	Stocks that have done well in the recent past will continue to do so	Buying winners, selling losers	Fama and French, 1993; Carhart, 1997; Moskowitz, Ooi and Pedersen, 2011; Ilmanen and Kizer, 2012
Low Volatility	Equity	Low volatility stocks earn high risk-adjusted returns, indicating that equity investors overpay for risky stocks. Possible explanations are leverage restrictions, inefficient two-step investment processes, and behavioral biases of investors.		Blitz & van Vliet 2007, Van Vliet, 2011
Term	Bonds	There is generally a positive difference between long term and short term interest rates due to (among other explanations) forward looking expectations, liquidity preferences, or market segmentation.		Ilmanen, 1996; Cox, Ingersoll & Ross, 1985
Credit	Bonds	Compensation for the risk of default; usually linked to economic growth (prospects)		Gebhardt, Hvidkjaer & Swaminathan, 2005; Ilmanen & Kizer, 2012
Short-Term and Long-Term Reversal	Equity			De Groot, Huij and Zhou, 2012
Volatility	Equity	Sellers of protection earn a risk premiums embedded in the implied volatility for providing insurance	VIX Index Future;	



	Factor Found In	Economic Rationale	Application	Research
Variance swap – the difference between the VIX and realized volatility	Ang et. al, 2006, 2009			
Liquidity	Equity, Bonds		No consensus on how to capture this measure	Li, Mooradian and Zhang, 2007; Pastor and Stambaugh, 2003
Emerging Equity Markets	Equity			Bhansali, 2011a; Website David Hsieh; Ritter, 2006; NBIM, 2010
Convexity	Bonds	Bonds with a higher convexity produce better results in volatile markets		
Strategy Factors				
Carry	Bonds, Currency	Forward rates overestimate future spot rates		Hodrick, 1987; Froot and Thaler, 1990
Trending	Equity, Bonds, Currency, Commodities		Look back straddles	
Anomaly	Mostly equity	Anomalies such as accruals anomaly, IPO-anomaly, index-change anomaly Calendar effects, such as the 'Turn-of-the-Month' effect or the 'pre-holiday' effect		

Biographies



Kees Koedijk is Professor of Financial Management at Tilburg University and Dean of TiasNimbas Business School. Kees Koedijk is an expert in the field of financial economics and financial markets. His areas of research include: Macro and International Finance, Portfolio Management and Socially Responsible Investment, Risk Tolerance and Emotion. In addition to his position as head of faculty, he is also active in the area of sustainability.



Alfred Slager is Director of Tilburg University's CentER Applied Research. He worked as an asset manager for Fortis Investments, was investment strategist and policy adviser at PGGM and Chief Investment Officer at the Stork pension fund. His research focuses on the structure of the financial sector, specifically the world of pensions. His specialization is the design, implementation and governance of the investment processes at pension funds and institutional investors.



Philip Stork is Professor at the VU University Amsterdam and is affiliated to the Duisenberg School of Finance. He was director at MeesPierson, Fortis Bank Nederland and Van der Hoop Bankiers. He was also Professor at Erasmus University Rotterdam and Visiting Professor to Massey University in New Zealand. His research focuses on financial markets and financial instruments, with key areas including investment strategies, risk management, trading, banking and market behavior.

