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Factor Investing: A New Paradigm for Superannuation Funds and Investment Managers

The investment landscape for large superannuation funds and their investment managers is changing, and changing dramatically. Consider just some of the potential game-changers: the trend toward index- and rules-based investments, insourcing investment management, customisation requirements for risk, tax and ESG, and the separation of accumulation and pension mandates. Each of these trends shifts power from the manager to the superannuation fund. Both funds and investment managers need to carefully think through the ramifications of these changes to the “balance of power”.

This paper examines one of these changes: factor-based investing. Over the past decade, the indexing community has expanded its scope from passive capitalisation-weighted indexes to an entire host of “smart beta” indexes, which often rely on well-known active ideas, or factors, implemented in a transparent, rules-based strategy. We explain what factor-based investing is, how it differs from active and passive management, and why many funds will be attracted to it.
As index providers venture into the active management world, two immediate questions are worth exploring:

1. What are the ramifications of the factor investing trend for active equity managers?
2. If superannuation funds are going to seek specific factor exposures, how should such a strategy be implemented?

Due to its low fee structure, the factor investing movement has the potential to disrupt the business model of active equity managers. However, this creates an opportunity for active managers to reposition themselves along the continuum of the superannuation fund clients’ investment needs. There is also a very real risk that funds seeking “smart beta” will instead find overly simplistic and poorly-constructed active strategies—in other words, dumb alpha. The most common problems we find when looking at smart beta strategies are the unintended risk factor biases.

To study the issue of unintended active bets in more detail, we construct a global equity strategy that targets the value factor exposure and illustrate how sophisticated optimisation techniques with good attention to constraints (risk bounds) can give a superannuation fund the desired value exposure with efficient use of active risk to attain that exposure. We show that this risk-constrained approach can actually improve risk-adjusted returns and give a superannuation fund an array of levers to deliver a finely-tuned, custom factor solution to precisely fit the fund’s investment needs. There is no stopping the trend toward taking active risks via systematic, factor-based strategies. The only question is how managers and superannuation funds will respond to this changing environment.

WHAT IS FACTOR-BASED INVESTING?

Factor-based investing begins with the premise that the differences in stock returns can be explained by a set of common, discrete factors or risk premia. Relative to a market capitalisation-weighted portfolio, a factor-based equity portfolio seeks greater exposure to stocks identified as having (being correlated with) the desired factor risks in order to produce returns which exceed market returns. In a simple unlevered portfolio, this necessarily implies underweighting stocks which possess less of the desired factor risks. Factor-based investing can be thought of as a type of smart beta investing, falling somewhere between passive index investing and traditional active management.

Though academic literature has identified hundreds of purported risk factors\(^1\), the ones which have received popular acceptance and attention are size, value, momentum, quality, low volatility, dividend yield and profitability. Our observation is that value and low volatility are the two factors receiving most consideration amongst superannuation funds in Australia at present. Over the years, all the factors we have listed have been studied and shown to deliver meaningful risk-adjusted excess returns over a market-capitalisation-weighted portfolio\(^2\). Researchers have also found that combining factors can be effective; for example, value/quality and momentum/low volatility have been found to be complementary factor pairs\(^3\).

The source of the excess returns from factor risks is an active area of investment research. Current studies suggest that the excess returns can be attributed to systematic risk or pricing errors. For example, superannuation funds exposed to the value factor may bear more business cycle risk, therefore their excess return compensates for this risk. Studies also suggest that the low volatility excess return can be explained by the systematic pricing errors arising from investment managers’ inability to take on leverage\(^4\).

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\(^1\) See Cochrane [2011] and Hsu [2014].
\(^2\) See Santodomingo, et. al. [2015].
\(^3\) For further discussion on combining factor strategies see Nemtchinov and Pritamani [2016].
RAMIFICATIONS OF FACTOR TREND FOR ACTIVE MANAGERS

Factor-based investing employs a very different approach to those used by the traditional active equity manager. Traditional active managers conduct extensive bottom-up fundamental research on individual companies and then construct a portfolio of stocks determined to be most undervalued or to have attractive growth prospects (or some other desired characteristic; for example, defensive characteristics). The important insight behind the factor trend is that much of the alpha generated by traditional active managers through this process can be explained by common factors, and as an alternative to intensive research, simple rules can be constructed to harvest these same factors.

One high-profile example of this insight is the USD $889 billion Norwegian Government Pension Fund which commissioned an external report in 2009 after its actively managed investment portfolio failed to meet its return target. The report states:

“In fact, approximately 70% of all active returns on the overall Fund can be explained by exposures to systematic factors over the sample. It is appropriate that the Fund has exposure to these factors: these are associated with risk premiums that the Fund, as a patient investor, can seek to harvest over time, just in the way that, with an exposure to the market portfolio, it has sought to harvest the equity risk premium.”

The report further stated that:

“In light of the relative importance that factor exposures already play in the Fund’s returns, we suggest that the Fund consider a framework that more explicitly recognizes the structure of its return generating process via investment in factor benchmark portfolios.”

Subsequently, the Fund adopted a formal factor-based investing approach based on size, value and growth factors. What a follow up report noted—and what is instructive to active managers—is that the Fund’s factor approach became one facet of a multi-pronged approach, which also included security selection by way of external active managers and internal programmes.

This case study helps to explain the attraction of factor-based investing to a superannuation fund—it can, at least potentially, substitute for a large component of the fund’s active management programme in a way which gives the fund more control over its investment objectives and outcomes and more transparency about the risk and return drivers of the portfolio—attractive in the business of managing the complex myriad of stakeholder interests in superannuation fund investment outcomes. What must also, obviously, be an attraction in this era of fee pressures is the lower cost of factor-based investing compared to active management.

There is, however, encouraging news for active investment managers: the take up of factor strategies does not necessarily mean less business but rather, as the Norwegian Fund case study indicates, a freeing up of a fund’s fee budget to seek truly complementary active management to harvest returns from specific investment insights and idiosyncratic risk. Theoretically, superannuation funds should be asking their active managers to each respond in one of two ways:

1. Adopt the genuine mantle of a factor risk/return provider; or
2. Clearly differentiate him/herself from the providers of systematic factor returns as a manager who can generate returns from true, idiosyncratic risks and insights.

In practice, the pricing of factor strategies relative to active equity strategies will make the first option unpalatable to most managers. Further, the systematic, rules-based factor approaches superannuation funds are seeking will be counter-cultural to many active managers (with the exception of quant managers). In recognition of this, we have seen passive and specialist implementation managers, rather than active managers, reposition to fill this demand.

5 See Ang et.al. [2009]
6 See Ang et. al. [2014]
This leaves active managers with the only practical option of delineating themselves as active harvesters of non-factor, idiosyncratic risk to complement their clients’ separate factor strategies. This may in fact be an exciting development for managers that do so, as they should logically be provided by their superannuation fund clients with a generous risk budget to pursue these insights.

**IN SEARCH OF THE “FORMULA ONE” FACTOR PORTFOLIO**

We have now explained the attraction of factor approaches and, hopefully, clarified how factor and active management strategies can sit as amicable bedfellows in a superannuation fund’s overall investment approach. This leads to the next, important question: how should the fund (or the specialist implementation manager hired by the fund) implement a factor-based investment approach?

Constructing a successful factor strategy portfolio is like building an engine. For any high-performing engine—for example, a Formula One race car engine—one must be concerned with engine efficiency, ensuring that the energy consumed by the engine is efficiently transferred to high output to perform useful work. Similarly, superannuation fund investors need to consider if their factor strategies genuinely target the factor risk they are interested in with less interference from the unintended factor risks. Like a poorly designed engine where all pistons are firing, but very little work is done, an inefficient factor strategy may have high overall active risk relative to the market capitalisation-weighted benchmark, but only a small portion of this active risk may actually come from the intended factor. This can lead to a portfolio full of unpleasant surprises where the portfolio outcomes do not match stakeholder expectations, which happens when a fund seeks active risk based on a simplistic and not smart investment design.

The S&P 500® Dividend Aristocrats® Index is an example of a factor approach which has been accused of suffering from such inefficiency: even though the strategy is marketed as a dividend-focused strategy, the portfolio provided less than half the dividend yield factor exposure of other dividend-oriented indexes and comes with a large bias toward the low volatility factor.

So how can a superannuation fund achieve a “Formula One” factor standard? The answer, in our view, lies in the use of optimisation techniques to construct the portfolio and the careful setting of constraints, or risk bounds, as part of this portfolio construction. In the next section of this paper, we introduce a simulated strategy which aims to achieve exposure to the value factor in an international equities portfolio. We demonstrate with this example a practical factor portfolio implementation approach which involves optimisation to gain high exposure to the value factor while using bounds as a way of managing other risks relative to the capitalisation-weighted investment universe. To measure how efficient we are in using active risk to gain the desired value exposure, we calculate the percentage contribution to tracking error from the value exposure. This measure is a ratio of the contribution to active risk from the targeted value factor to the total active risk coming from all factors in the factor risk model under consideration. The higher the percentage contribution to risk, the more efficient the factor strategy is.

**DATA AND METHODOLOGY**

We construct our investable universe by selecting large- and mid-capitalisation stock constituents of the S&P BMI Global index for developed countries defined in the MSCI World index. Our investable universe includes 1500 to 2050 stocks and 20 to 24 developed countries during the period from January 1997 to December 2015. We use an optimisation model to maximise the targeted value factor exposure and demonstrate the effect of controlling unintended risks using stock, factor, country, and sector bounds. We rebalance the portfolio annually to keep turnover and implementation costs of the value strategy low.
Academics and investment professionals have long argued that over extended time horizons—which characterise a typical superannuation fund’s equity perspective—value strategies outperform the market. Value investing involves buying stocks that appear cheap relative to some underlying stock characteristic, such as stocks that have low price-to-book, price-to-earnings, or price-to-sales ratios. Many existing quantitative products aimed at delivering systematic exposure to the value factor (including value style indexes and broad-based portfolios tilted towards the value factor) adopt a common approach to portfolio construction. They select value stocks by first sorting all stocks in the investable universe on one or several price multiple ratios. Next, stocks which are determined to be expensive based on these estimates are either removed from the portfolio or underweighted.

We argue that, in order for this to deliver an efficient factor strategy, additional steps must be taken in the practical construction of the portfolio to reduce unintended exposure risks. If stocks exhibiting value characteristics are not distributed uniformly across sectors, countries and capitalisation segments, then a portfolio seeking to maximise value exposure will exhibit biases along these dimensions. Many fundamental stock characteristics captured by the factors may exhibit residual relationships and in some cases these relationships could be quite strong. The following examples show how easy it can be to make the mistake of introducing unintended factor bets in the pursuit of a pure value exposure:

- **Unintended short profitability bias** - value and profitability factors exhibit particularly strong relationships and a portfolio seeking high value exposure may inadvertently tilt towards fundamentally cheap but unprofitable companies (Novy-Marx [2013]).

- **Unintended short momentum bias** - some market cycles can exhibit a negative correlation between value and momentum factors and at these times a value-oriented portfolio will exhibit a large negative momentum bias.

- **Unintended long size bias** - in some periods, smaller companies can exhibit cheaper fundamental valuations, meaning the value portfolio will have strong small-cap size factor bias.

These are the inefficiencies—large unintended factor concentration risks—that a “Formula One” factor strategy needs to avoid, as they may result in poor portfolio diversification and produce unwelcome surprises in investment outcomes.

Constraints can be useful for managing risks but they could also be harmful by limiting a superannuation fund investor from achieving its investment objectives. We study these trade-offs by comparing targeted factor exposures and tracking error while varying constraints. Constraints also help our factor strategy to become more focused by reducing the amount of risk coming from the unintended exposures and increasing the percentage contribution to tracking error coming from the targeted factor. This provides a superannuation fund with an efficient risk budgeting tool. This attention to detail is to highlight that the practical choice of constraints is a crucial one as different settings produce a wide variation of outcomes. A factor approach which offers the superannuation fund insights about the impact of different constraint settings is actually offering the fund something valuable—a set of levers which can be finely tuned to tailor the factor solution to the exact needs of the superannuation fund.

We use the MSCI Barra Global Equity model both for risk management and to define the value exposure of each stock. The value exposure is defined using standardised z-scores and measures how many standard deviations the exposure is above or below its universe mean. Since z-scores are expressed in units of standard deviations, they allow for easy comparison of factor exposures between portfolios. Typically, a large capitalisation-weighted index will have a negligible or close to zero exposure to the value factor. A portfolio which is oriented towards value will have a positive exposure to that factor.

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10 Some researchers argue that the value premium reflects compensation for bearing risk (Fama and French [1992]). Others argue that the value premium is driven by mispricing arising from the tendency of investors to overreact (Lakonishok et. al. [1994]). For instance, if investors extrapolate past earnings growth too far into the future, it would result in growth stocks being overpriced. Similarly, if investors oversell stocks that have performed poorly, it would result in these out-of-favour value stocks to be underpriced.

11 We define value factor exposure by combining Barra’s Value factor (book-to-price) and Earnings Yield factor (earnings-to-price) in a 3:1 ratio. Our relative weightings emphasise the importance of the book-to-price valuation characteristic employed by many investors; however, other weighting schemes produce similar results.
RESULTS

We start by constructing simple, cap-weighted value portfolios. Figure 1 shows the results for 2x, 4x, and 8x Value portfolios. The 2x Value portfolio represents a cap-weighted portfolio of the top half of the value universe. This is constructed by letting the optimiser maximise the value exposure subject to individual stocks weights not exceeding two-times their capitalisation weight. Similarly, the 4x and 8x portfolios represent the top fourth and top eighth of the value universe respectively. Excess returns and tracking error are computed by comparing the value portfolios to the underlying capitalisation-weighted universe.

Figure 1: Cap-Weighted Value Portfolios, 1997-2015

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Value Exposure (%)</th>
<th>Tracking Error (%)</th>
<th>Factor Percentage Contribution to Tracking Error (%)</th>
<th>Excess Return (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Half (2x constraint)</td>
<td>0.81</td>
<td>4.01</td>
<td>17.55</td>
<td>0.48</td>
</tr>
<tr>
<td>Top Fourth (4x constraint)</td>
<td>1.40</td>
<td>6.22</td>
<td>19.95</td>
<td>1.03</td>
</tr>
<tr>
<td>Top Eighth (8x constraint)</td>
<td>1.89</td>
<td>8.13</td>
<td>21.21</td>
<td>1.59</td>
</tr>
</tbody>
</table>

Back-tested data is hypothetical and provided for illustrative purposes. It does not represent the experience of any investor and is not a recommendation to adopt any investment strategy. All investments are subject to the risk of loss.

We observe that as we shift stock bound multiplier from 2x to 4x and finally to 8x, the portfolio is increasingly concentrated in the stocks with more attractive valuations and its value factor exposure more than doubles from 0.81 to 1.89. As the portfolio gets higher exposure to the value factor, it becomes more active and its tracking error increases from 4% to 8%. The increase in value exposure is accompanied by an increase in excess returns, as the investor was rewarded for exposure to the value premium over the sample period. While a more active strategy achieves a higher exposure to the value factor, the proportion of the active risk which is attributed to the value factor remains about the same in the range of 18% to 21%. This delivers an important insight to funds: while the factor strategy may become steadily more “active”, a large portion of active risk does not come from the targeted factor but rather from other unintended factor bets.

Our response is to apply constraints on unintended factor exposures to improve the portfolio’s focus on the targeted value factor without compromising the intended exposure to the value factor. For many superannuation fund investors, a very high tracking error in a systematic strategy with no company-specific analysis will be unpalatable, so we focus on the Top Fourth portfolio which has a tracking error of around 6% and study the effects of imposing additional constraints on this portfolio.

Specifically, we add the following constraints to the Top Fourth portfolio:

1. Unintended risk factors constrained to +/- 0.2 standard deviations. These are any factors that are unrelated to the value factor, for example: momentum, profitability, size, etc. Factors that are related, such as book-to-price, earnings yield, growth, and dividend yield are left unconstrained.
2. Country weights limited to +/- 5% of the market-cap weighted portfolio.
3. Sector weights limited to +/- 5% of the market-cap weighted portfolio.

Figure 2 demonstrates the effect on tracking error of imposing additional constraints. We see that constraining unintended risk factors cuts tracking error significantly from 6.2% to 3.5%, while sector constraints reduce tracking error to around 4.5%. Constraining countries doesn’t have much effect...
on tracking error suggesting that value stocks are distributed uniformly across countries. Imposing all constraints simultaneously causes tracking error to fall to 3.4%. The reduction in tracking error does result in a lower value exposure; going from 1.4 to 1.2 standard deviations. However, the decrease in value factor exposure appears negligible relative to the change in tracking error.

Figure 2: Value Factor Exposures and Tracking Error For Developed World Value Portfolios, 1997-2015

Figure 3 shows how the factor percentage contribution to tracking error changes as we impose the additional constraints. We find that constraining unintended risk factors has the biggest impact on improving this metric from 20.0% to 35.9%. Sector constraints also have a material effect in improving this metric to 28.6%, while country constraints have no material effect.

Figure 3: Value Factor Percentage Contribution to Tracking Error For Developed World Value Portfolios, 1997-2015
The results in Figures 2 and 3 together point to a dramatic improvement in the active risk budget when constraints are imposed to reduce unintended exposures for countries, sectors and non-targeted risk factors. For a small reduction in exposure to the value factor, the constraints help reduce tracking error significantly, and allow for a much larger portion of the active risk budget to come from the targeted value exposure. In other words, the constraints help reduce the risk from the unintended exposures while retaining most of the targeted value factor exposure. The engine in our “Formula One” factor strategy is revving! The improvement in the percentage contribution to tracking error from the value factor to 35% is substantial when compared with values in the range from 10% to 20% for many well-known value-oriented global indexes.

Finally, we examine the effect on excess returns of imposing these unintended exposure constraints. These extra active bets may help or hurt the portfolio performance, depending on the performance of the unintended exposures over the sample period. Figure 4 shows an improvement in returns as constraints are added. A large part of the improvement is due to the high excess returns of profitable companies over this period. The unconstrained value strategies picked up a large negative exposure to the profitability factor and experienced lower returns as a result. Sector exposures and many other factors contributed to the differences in performance.

In some periods—or for different factors in different regions—the addition of constraints may reduce the excess returns. However, we find that the information ratio generally improves as constraints are added. This is because the tracking error is reduced significantly, while the excess returns are only marginally affected. Reducing unintended active bets tends to improve the risk-adjusted performance of the portfolio.

**Figure 4: Excess Returns For Developed World Value Factor Portfolios, 1997-2015**

Back-tested data is hypothetical and provided for illustrative purposes. It does not represent the experience of any investor and is not a recommendation to adopt any investment strategy. All investments are subject to the risk of loss.

### CONCLUSION

We commenced this paper with an explanation of factor-based investing and its attraction to superannuation funds. Many are now treading the factor path paved by the innovative examples of large overseas funds like the Norwegian Government Pension Fund. The challenge this issues to the funds’ active equity managers is, practically, for the manager to reposition him/herself along the continuum of their clients’ needs to become a complement to the fund’s discrete factor approach.
A good manager will find that this repositioning translates into new, or reaffirmed, mandates from their superannuation fund clients which award generous risk budgets to pursue the manager’s unique insights and idiosyncratic risks.

As this happens, we predict superannuation funds to, increasingly, look to develop their own factor insights and execute on these insights or partner with an external factor-based specialist implementation manager for the same. This led us to the second part of this paper which focuses on the implementation of factor-based investing, where we warned of the inefficiencies caused by unintended factor bets. These extra active tilts load a portfolio with unwelcome surprises which can be a nightmare for those managing the expectations of stakeholders, both internal and external.

We finished by studying an optimised global equity value strategy to highlight the need to control for unintended factor exposures. The way to solve this problem is by carefully setting constraints or “risk bounds” as part of a sophisticated portfolio optimisation process. We also suggested a metric to determine the success of this endeavor—the factor percentage contribution to active risk—which estimates what proportion of the active risk is coming from the targeted factor exposure. The ideal factor approach will have a large portion of its risk budget consumed by its targeted factor exposure, with smaller portions allocated to the other factor exposures.

Stepping back, we highlight two important and encouraging findings in these results. First, we have challenged the traditional view that bounds are a risk management tool employed at the cost of achieving targeted returns (a necessary cost to control risks). We have shown, in fact, that bounds on unintended factor exposures, critical to deliver a focused factor strategy, can improve risk-adjusted returns. Second, constraint setting is actually offering a superannuation fund investor a valuable set of levers which can be finely tuned to tailor the factor solution to the exact needs of the superannuation fund. This level of power, control and transparency is a world away from relying on the factor exposures embedded in a myriad of active management strategies. As more funds seize this opportunity, they must rise to the important challenge of ensuring they get what they want, that is, a truly efficient, well-targeted factor solution.

**REFERENCES**


