



EFFICIENT  
FACTOR  
INVESTING  
STRATEGIES

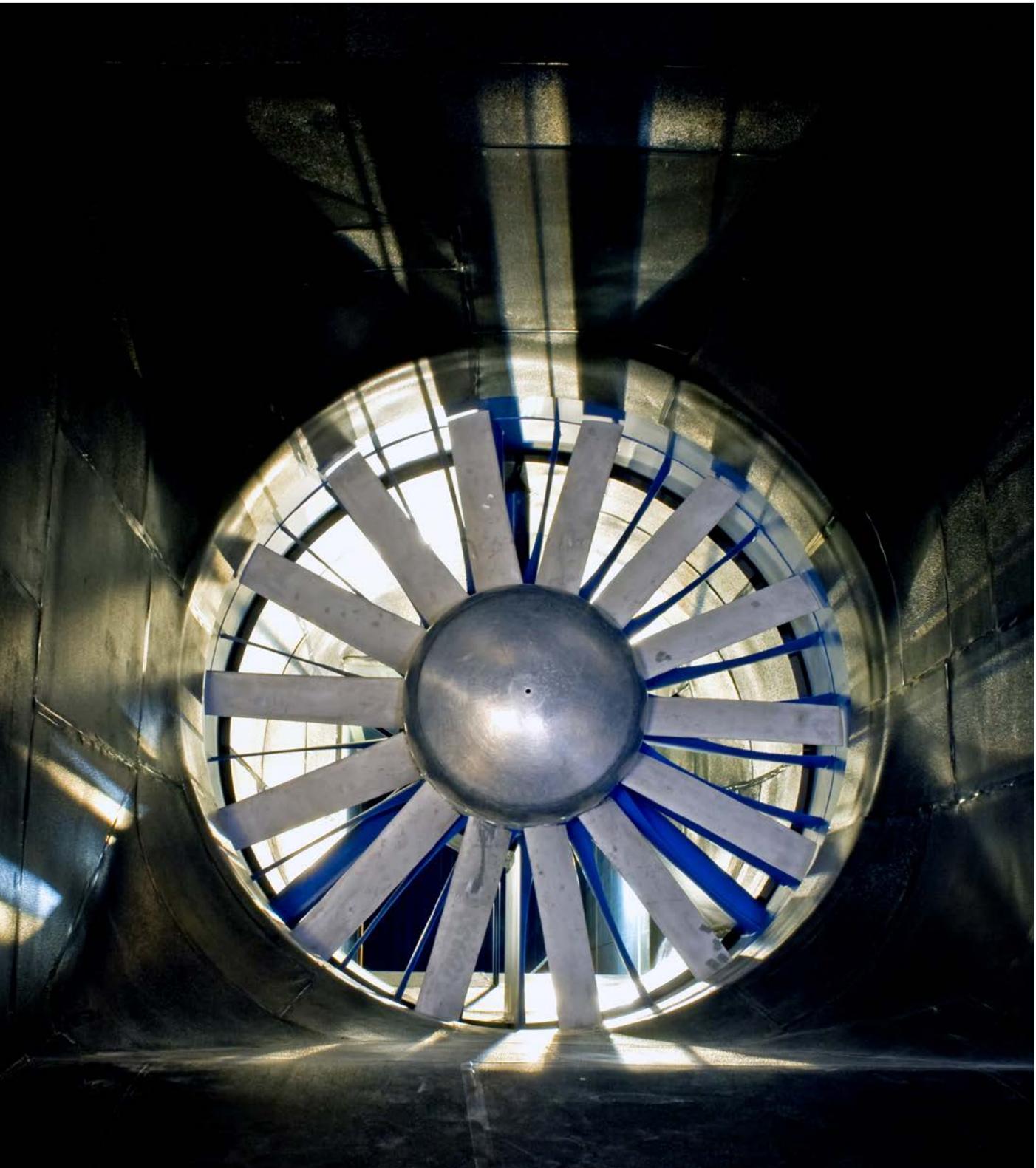
**WHITE PAPER**

For professional investors  
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## The rise of factor investing

Is the capitalization-weighted broad market index an efficient portfolio? This is a fundamental question which every investor should think carefully about. If the answer is affirmative, investing is pretty simple. All an investor needs to do in this case is to simply replicate the broad market index, which can be done at minimal costs nowadays. The academic literature, however, indicates that this is probably a suboptimal approach.

Numerous studies in the stream of literature on empirical asset pricing have shown that stocks with certain factor characteristics deliver superior risk-adjusted returns. Examples of such factor premiums include the value effect, the momentum effect, and the low-volatility effect.

However, this does not mean that it is easy to 'beat the market'. In fact, since all investors together comprise the market, it is not surprising that mutual funds on aggregate have been found to underperform the market after fees and expenses. Interestingly, however, the literature on mutual fund performance evaluation also documents that certain groups of funds do succeed in systematically generating superior results. Moreover, there appears to be a close link between these studies and the asset pricing literature, as most of the alpha of winner funds can, in fact, be explained by the same factor premiums which have emerged from the asset pricing literature; see, e.g. Carhart (1997). In other words, the best mutual funds appear to benefit from proven factor premiums.

**Practical implications** | But what are the practical implications of these findings? The answer was recently provided by three renowned professors: Andrew Ang (Columbia Business School), William Goetzmann (Yale School of Management) and Stephen Schaefer (London Business School). These professors were consulted by Norges Bank Investment Management (NBIM), one of the largest investment managers in the world, responsible for managing EUR 700 billion of Norway's oil wealth, to critically evaluate the added value of its active management. In line with Carhart (1997), they found that approximately 70% of all active returns to NBIM since its inception in 1998 could be explained by exposures to various systematic factors. The analysis also highlighted that these factor exposures were actually a byproduct of bottom-up security selection by the managers hired by NBIM. The authors recommended NBIM to begin using a more top-down, intentional approach to strategic and dynamic factor exposures, and to examine how individual factor premiums could be harvested in the most efficient manner. After this research was made public in 2009, strategic allocation to factor premiums was dubbed by some as 'the Norway model'.

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'Stocks with certain factor characteristics deliver superior risk-adjusted returns'

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Robeco has contributed to this debate by conducting a study on how investors may apply factor investing to their equity portfolio in practice. We found that the value, momentum and low-volatility premiums have been particularly large and robust over time and over different markets. Even using more conservative expected returns for the future, we found that the optimal allocation to these premiums should be sizable. Moreover, the allocation to factor premiums should be diversified (where a simple 1/N approach already seems to be quite efficient) and determined strategically (in order to avoid chasing recently winning styles).<sup>1</sup> Interestingly, similar factor premiums appear to be present in other asset classes, such as bonds<sup>2</sup>, and commodities<sup>3</sup>.

<sup>1</sup>Blitz, "Strategic allocation to premiums in the equity market", *Journal of Index Investing*, 2012

<sup>2</sup>Houweling, et al, "The low-risk anomaly in credits", in *Low-Volatility Investing*, 1st edition, Rotterdam, Robeco collection of articles, 2012

<sup>3</sup>Blitz and de Groot, "Strategic allocation to commodity factor premiums", forthcoming *Journal of Alternative Investments*

## Pitfalls of factor indices

One way to capture factor premiums in practice is by following an index which is either explicitly or implicitly designed to benefit from factor premiums. Examples are value-weighted indices, equal-weighted indices and risk-weighted indices. Several index providers (such as MSCI and FTSE) provide such alternatively weighted indexes, and passive managers have introduced index funds and exchange-traded funds which follow such indexes. While factor beta or 'smart beta' approaches have proven that they are able to benefit from factor premiums, investors should be aware of their pitfalls.<sup>4</sup> Examples of such pitfalls include uncompensated risks, high turnover and going against other factor premiums. A more sophisticated approach may therefore offer significantly better performance.

**A more sophisticated approach** | For many years, the Robeco Quantitative Research team has concentrated on analyzing, evaluating, and designing various factor strategies. We found it is of crucial importance to understand the source of a factor premium and then use this information to implement factor strategies efficiently. Key issues with efficient implementation are removing unrewarded risks and limiting unnecessary turnover. Below is a synopsis of what we've discovered about value, momentum, and low-volatility investing over the years.

**The value premium** | The value effect is the tendency for inexpensive stocks, measured for example by the price-to-book ratio, to have above-market returns. It is well documented in the academic literature, where it has been identified over long time periods and in a variety of regions, including the US, Japan, Europe and emerging markets. One stream of literature proposes that the value premium is a compensation for risk. Professors Eugene Fama and Kenneth French argue that the value premium specifically reflects a reward for relative distress risk, although empirical evidence supporting this assertion has been elusive.

We studied the supposed positive relationship between distress risk and the value effect using a simple premise: if the value premium is a compensation for distress risk, the return from value should rise as bankruptcy risk increases. We tested a number of different measures of distress risk, including accounting models, structural models, credit spreads and credit ratings, and used a conventional implementation of a value strategy, based on price-to-book. While we found that conventional value strategies are typically exposed to distress risk, we found no empirical evidence that distress risk explains the value premium.<sup>5</sup>

We believe our research finding has significant implications for investors in value strategies, as our results show that it is not necessary to take on distress risk in order to profit from the value premium. A more sophisticated value strategy may be designed by explicitly avoiding financially distressed firms.

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'Investors should be aware of the pitfalls of smart beta'

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<sup>4</sup>For a more extensive discussion of the pitfalls of smart beta approaches we refer to: Blitz, "How smart is 'Smart Beta' investing", *Journal of Indexes*, March/April 2013

<sup>5</sup>De Groot and Huij, "Is the value premium really a compensation for distress risk", *SSRN working paper no.1840551*.

**The momentum premium** | Momentum is the tendency for stocks that have performed well in the recent past to continue to perform well; and for stocks that have performed poorly to continue to perform poorly. The momentum effect was first documented in the early nineties,<sup>6</sup> and has been confirmed in numerous subsequent studies. The momentum effect has also been found to be responsible for most of the persistence in actively managed fund performance.

There are two well-documented issues that plague the implementation of a momentum strategy. The first and biggest hurdle to exploiting momentum is the risk associated with momentum investing. Although momentum offers high average returns in the long run, the short-term performance can be very poor, such as in 2009. The second concern with momentum investing is that it involves high turnover and therefore significant trading costs. Our research and experience show that these concerns can be effectively addressed by avoiding unrewarded risks and by not trading too aggressively.

While there is a broad consensus that the momentum effect exists, there is no consensus as to why. Just as with other anomalies in the equity market, risk has been proposed as the source of the momentum premium, although, again, this does not convincingly explain the premium. Other interpretations attribute the momentum factor to mispricing that arises from a gradual diffusion of information in the market. What we found, in contrast to other academic studies, was that although momentum appears to involve little exposure to risk factors in the long run, these exposures can be huge in the short run. A conventional momentum strategy tends to involve large negative or positive betas, depending on recent market returns. This characteristic is beneficial when markets are trending. But when, for example, they suddenly revert, as occurred in 2009 when many stocks that were hit hard by the credit crisis showed a recovery, a simple momentum strategy may exhibit large negative returns.

Our research looked into the risk intrinsic to a momentum strategy.<sup>7</sup> We found that half of the risk does not contribute to the strategy's return. We then developed a proprietary risk management technique to remove these unrewarded risks. The application of this risk management technique for momentum strategies halves the volatility compared with a conventional momentum strategy, while maintaining the strategy's returns, which results in a doubling of the Sharpe ratio.

**The low-volatility premium** | The low-volatility anomaly was first documented by Robert Haugen and others who tested the capital asset pricing model (CAPM) in the early 1970s. In a long-term study of the US market, Haugen demonstrated that contrary to what is expected by CAPM, low-risk stocks have high risk-adjusted returns.<sup>8</sup> His research, however, was virtually ignored for decades. We started our work on the subject of low volatility in 2005 and found that the volatility effect is still strongly present in the US market. We also provided strong out-

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'This risk management technique for momentum strategies halves the volatility'

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<sup>6</sup>Jegadeesh and Titman, "Returns to buying winners and selling losers: implications for stock market efficiency," *Journal of Finance*, 1993

<sup>7</sup>Blitz, Huij and Martens, "Residual momentum," *Journal of Empirical Finance*, 2011

<sup>8</sup>Haugen and Heins, "On the evidence supporting the existence of risk premiums in the capital market," University of Wisconsin Working Paper, December 1972

of-sample evidence for the European and Japanese equity markets.<sup>9</sup> Moreover, we found that the anomaly seems to have grown stronger over time, and that it is strongly present among the largest, most liquid stocks in the market.

Generic low-volatility strategies are typically based on a single backward-looking historical risk measure, such as volatility or beta. This construction, however, may expose the strategy to some pitfalls of low-volatility investing, including miscalculated downside risk and underperformance in sharply rising markets. A more sophisticated approach to low-volatility investing can overcome these pitfalls by taking a multi-dimensional view at risk and using a combination of low-risk variables that include both long- and short-term statistical factors.

Our research in optimizing low-volatility strategies also finds that limiting distress risk by augmenting backward-looking risk measures with forward-looking measures helps to better estimate and reduce the expected tail risk of a low-volatility strategy.<sup>10</sup> We believe that a more sophisticated approach to low-volatility investing is necessary, because not all low-volatility stocks are equal and some are destined to perform better than others. This is especially true when low-volatility becomes expensive, as is the case in markets now.<sup>11</sup>

**Risk of factor premiums going against each other** | The examples above illustrate how unrewarded risks that are specific to the value, momentum, and low-risk premiums may be avoided. Another, more general form of unrewarded risk involved with harvesting factor premiums is individual factors having negative exposures to one another. Such a feature is highly undesirable because having negative exposures to factors with positive expected returns lowers the expected return. For example, if a factor index aims to harvest the momentum premium and this index has a negative exposure to the value premium, the expected return on the index is not only a function of the momentum premium, but also of the value premium. And because the expected return of the value premium is positive, the negative exposure of the factor index is expected to hurt its performance. Efficient approaches to obtain factor premium exposure should therefore be designed in such a way that premiums do not go against each other and thereby hurt performance.

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‘Investors should be aware of the pitfalls of smart beta’

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<sup>9</sup>Blitz and van Vliet, “The volatility effect: lower risk without lower return”, *Journal of Portfolio Management*, Fall 2007

<sup>10</sup>Huij, van Vliet, de Groot and Zhou, “How distress risk can improve low-volatility strategies: lessons learned since 2006”, in *Low-Volatility Investing*, 1st edition, Rotterdam, Robeco collection of articles, 2012

<sup>11</sup>Van Vliet, “Enhancing a low-volatility strategy is particularly helpful when generic low volatility is expensive”, Robeco, June 2012. Available at [www.robeco.com/lowvolatility](http://www.robeco.com/lowvolatility)

## Bringing it all together

To gauge the economic significance of the insights we discussed in the first part of this note, we performed a series of empirical analyses. First, we analyzed the performance of popular index-based strategies for obtaining value, momentum, and low-volatility factor exposure. For the index-based strategies we used the MSCI World Value Weighted index, the MSCI World Momentum index and the MSCI World Minimum Volatility index. For comparison purposes, the performance characteristics of the conventional capitalization-weighted market index are also included.

**Intentional and efficient exposure to factor premiums** | As table 1 below shows, all three index-based strategies deliver a superior risk-adjusted performance relative to the market, with the return/volatility ratio being in the 0.6-0.7 range, versus 0.5 for the market. For value and momentum this improvement mainly comes from a higher return, while for low-volatility it mainly comes from a lower risk. These results empirically confirm the added value of factor investing.

'All three index based strategies deliver a superior risk-adjusted performance'

**Table 1. Performance generic factor strategies**

	MSCI World	MSCI Value	MSCI Momentum	MSCI Low-vol
Return	7.6%	9.4%	10.7%	8.1%
Volatility	15.3%	15.5%	15.8%	11.4%
Return/volatility	0.50	0.61	0.68	0.71

Source: Robeco, MSCI. Average returns are calculated geometrically. Sample period: 1988:05-2013:12. Base currency: USD. Largely based on simulations and partly on real-life data.

Next, we computed the same performance metrics incorporating the insights described in the first part of this paper. The results are displayed in table 2 below. Compared with table 1, we observe a significant further improvement in performance, with return/volatility ratios in the 0.8-1 range. This implies that the added value of the Robeco factor solutions is over double that of the index-based solutions. In fact, this still understates the difference in added value, because for the Robeco factor solutions the impact of trading costs is conservatively taken into account, while the index returns conveniently ignore such costs.

**Table 2. Performance Robeco factor strategies**

	MSCI World	Value+	Momentum+	Low-vol+
Return	7.6%	13.4%	12.8%	12.2%
Volatility	15.3%	15.4%	15.4%	11.6%
Return/volatility	0.50	0.87	0.83	1.05

Source: Robeco, MSCI. Average returns are calculated geometrically. Sample period: 1988:05-2013:12. Base currency: USD. Based on simulations.

Across the board, the improvements in the Sharpe ratios come from both an increase in return and a decrease in risk. The risk reductions are largely due to avoiding unrewarded risks, as described earlier. The risk budget that is released by avoiding the unrewarded risks also enables the efficient approaches to seek higher exposures to the factor premiums (i.e., through higher concentration and active share) resulting in higher returns. For instance, whereas the MSCI Value Weighted index has an active share of only about 25%, the corresponding figure for the Robeco Value strategy is around 90%.

The returns are also higher because of differences in exposures to other factors. For example, the MSCI World Value Weighted and the MSCI World Minimum Volatility indexes both exhibit a negative exposure to the momentum premium, whereas the efficient factor premium strategies are designed to avoid negative exposures to other factor premiums. Based on the above results, we can conclude that the added value of our research insights is sizable.

**Confirmed by live track-records** | Our live track-records confirm the added value of Robeco factor strategies. As table 3 shows, our factor funds have not only handsomely outperformed the regular capitalization-weighted index, but also their corresponding factor indices. We note that these results would be even better on a risk-adjusted basis, in particular for our low-volatility (Conservative Equities) strategies, which have lived up to their promise of delivering a much lower volatility than the capitalization-weighted index.

**Table 3. Live performance Robeco factor strategies versus MSCI factor indice**

	Value all-country	Momentum all-country	Low-vol developed	Low-vol emerging
Start month	Jan 2014	Sep 2012	Oct 2006	Mar 2011
<b><i>Versus regular index</i></b>				
Robeco	10.58%	18.96%	7.21%	10.30%
MSCI	6.86%	15.18%	4.30%	1.29%
Excess return	3.72%	3.78%	2.91%	9.01%
<b><i>Versus factor index</i></b>				
Robeco	10.58%	18.96%	7.21%	10.30%
MSCI	6.66%	13.55%	4.63%	7.68%
Excess return	3.92%	5.40%	2.57%	2.62%

Source: Robeco, MSCI. Returns are gross of fees and annualized for periods longer than 12 months. Base currency: EUR.

Data through 30 June 2014. Strategies are: Robeco Quantitative Value, Robeco Momentum and Robeco Conservative Equities. Indices are MSCI Value-Weighted, MSCI Momentum and MSCI Minimum Volatility (net return). The value of your investments may fluctuate. Results obtained in the past are no guarantee for the future.

## Combining factors

Finally, we consider various approaches to constructing factor-premium portfolios. Table 4 below shows the performance of different combinations of the value, momentum and low-volatility factors. We consider an equally-weighted (1/N) portfolio, a maximum-return portfolio, a minimum-volatility portfolio and a risk-weighted portfolio. For the maximum-return portfolio we take a fifty-fifty combination of value and momentum, assuming that these factors have the highest future expected return. The minimum-volatility portfolio is fully invested in the low-volatility factor. The risk-weighted portfolio weighs the individual factor strategies by the inverse of their long-term volatility, thereby establishing equal risk contributions. In unreported tests, we constructed several other portfolios, including portfolios optimized in-sample for maximum Sharpe ratio or maximum information ratio.

'Factor investing is beneficial in the long run in all of the cases'

**Table 4. Portfolio performance of different combinations of efficient factor strategies**

	Equally weighted	Maximum return	Minimum volatility	Risk weighted
<b>Absolute</b>				
Return	12.9%	13.2%	12.2%	12.8%
Volatility	13.5%	14.8%	11.6%	13.3%
Return/volatility	0.95	0.89	1.05	0.96
<b>Relative</b>				
Outperformance	5.3%	5.6%	4.5%	5.2%
Tracking error	4.9%	4.7%	7.1%	5.1%
Information ratio	1.06	1.19	0.64	1.02
<b>Factor allocation</b>				
Value+	33.3%	50%	-	30.1%
Momentum+	33.3%	50%	-	30.0%
Low-volatility+	33.3%	-	100%	39.9%

Source: Robeco, MSCI. Average returns are calculated geometrically. Sample period: 1988:05-2013:12. Base currency: USD. Based on simulations.

Basically, for all of the portfolios that we considered, we observe an improvement of the return/volatility ratio from 0.5 for the market portfolio to roughly 0.9 to 1.1 for the various factor-premium portfolios. While the performance improvement is significant in all cases, we observe substantial differences in returns, volatilities, and tracking errors across the alternative factor premium portfolios. For example, the minimum-volatility portfolio has the lowest absolute volatility, but also the highest tracking error. The maximum-return portfolio, on the other hand, has the highest absolute volatility, but also the lowest tracking error. We conclude that factor investing is beneficial in the long run in all of the cases that we examined. There is, however, no single optimal factor-investing portfolio.

**Optimal mix depends on investor preferences** | The optimal factor-investing portfolio depends on investor-specific preferences for risk and return. For example, a pension fund where funding-ratio stability is the primary concern would probably be best off with a low-volatility implementation. On the other hand, an investor focused on maximizing expected return given a fixed allocation to equities, would probably be best off with a maximum-return implementation. We would generally advise, however, to diversify across multiple factor premiums, since individual factors may exhibit long drawdown periods and the drawdown period of a diversified factor portfolio is substantially shorter.

**Final words** | Institutional investors are increasingly allocating strategically to factor premiums. We recommend these investors to avoid risks that are not rewarded and that are not necessary for capturing factor premiums. We also recommend avoiding going against other factor premiums; limiting turnover and creating portfolios with a large active share.



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