



Factor equity investing

Considerations for reserve managers

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Factor equity investing

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In brief

- We have seen an increasing interest in factor investing, which enables investors to explore new drivers for diversification, increase portfolio transparency and risk management, and enhance investment returns
- But the non-standardised investment framework of the approach – especially the lack of benchmarks – goes against the institutional nature of reserve managers
- And constructing factor equity portfolios comes with increased operational complexity and a need for new risk management tools. Explaining this to internal stakeholders is an arduous task
- Academic research has shown that, over the long term, a factor approach can achieve superior risk-adjusted returns against a traditional market-cap investment
- Yet factors have also been seen to perform differently in different market regimes, which can lead to quarters or even years of underperformance. This makes it crucial for investors to determine their investment horizon and to agree on a clear definition of the factors to which they want exposure
- Overall, despite operational and practical hurdles, there are clear benefits to following a factor approach
- Excess returns of factors versus market-cap are usually quite marginal, depending on the chosen tracking error, but they can make a substantial difference to overall equity investment returns over the long-term
- A factor approach can also give a reserve manager a more granular understanding of the underlying risk and return of their portfolio
- It can help investors determine whether the under- or outperformance of the equity portfolio is driven by factors such as momentum, size, quality, value, volatility or yield
- Increased transparency of the underlying risks and returns of a portfolio can be very powerful

Introduction

Central bank investments are evolving

In the decade since the global financial crisis, expected returns on traditional reserve assets have fallen. Combined with this, the growth of global reserves over the past 20 years has contributed to central banks' increased interest – and investment – in equities.¹

For the most part, central banks are only considering passive strategies in market capitalisation-based equity indices. The Czech National Bank's equity build-up programme is a very progressive example of a successful integration of passive equity exposure into foreign reserves. Liquidity was one of the bank's main considerations when they set up their equity purchase plan, and "it was clear that only equities represented in the major indices"² were an option in the Czech National Bank's eyes.

The Swiss National Bank follows a similar investment philosophy when allocating assets into equities. For them, stock positions in line with key market-capitalisation indices are a very sensible choice, as this "ensures that there is no underweighting or overweighting at operational level in individual sectors or companies and that the Swiss National Bank thus operates as neutrally as possible in these markets."³ This is another example indicating that reserve managers generally prefer building up equity exposure through market-capitalisation-based indices, a preference also shown by many other central banks that have either already allocated assets into equities or are in the process of doing so.

The institutional nature of central banks leads them to follow a conservative and risk-averse approach within their investment framework. Therefore, in a world of inefficient liquidity and price signals across markets, passive fulfilment seems the most sensible approach. When it comes to their investment portfolios, reserve managers have clearly become much more conscious of the potential impact of passive equity on their balance sheet, which will no doubt support rising flows from the central banking community into passive equity solutions.

For the Czech National Bank, the move into passive equity generated healthy returns and enabled the bank's capital to become positive again "after years of negative equity,"⁴ though of course it could have been different in an environment of falling equity markets.

Within the wider investing world, equity investors are increasingly drawn to equity factors, rather than exclusively toward market-cap indices.⁵ And indeed, factor investing offers the potential for excess returns⁶ generally achieved through a rules-based, transparent methodology. A wealth of academic research supports the assertion that factors such as "value", "quality", "momentum" and "low volatility" have delivered excess returns with persistency over the long term.

For example, research published in 2013 by Clare, Motson and Thomas,⁷ using data on the 1,000 largest US stocks, every year from 1968 to the end of 2011, has shown that alternative-weighting strategies delivered better risk-adjusted returns than the cap-weighted index. While there is no guarantee that history will repeat itself, a number of sovereign wealth and sovereign pension funds have adopted these strategies, and some central banks are beginning to question whether a standard market-cap index really is the best way for them to gain equity exposure.

The ongoing repercussions of the global financial crisis, and in particular the continuous short-run asset-price fluctuations on markets, have led to these considerations. The investment challenges of recent years have increased investors' desire to gain a better understanding of the key drivers of risk and return. In 2017, sovereign institutions are not only looking at their investments in terms of what proportions they should allocate into the various asset classes, but they are expressing an interest in also understanding which factors drive asset-price returns. Many are exploring factor strategies in pursuit of this higher degree of return transparency, but also to gain a diversification benefit. Therefore, whilst approaches and execution are far from being uniform, the idea of factor investing is now widespread across the sovereign community.

In this paper, we will begin by putting the development of factor investing into context – including through a brief history of its rise to mainstream investing – before looking at factor-based investing in detail, questioning its value in a portfolio, and exploring the implicit and explicit nature of exposures. We will then consider the risks involved and take a closer look at low-volatility approaches.

Evolution or revolution?

Adding value within an allocation

The appeal of traditional market cap-weighted investing is based on the notion of efficient markets. Cap-weighted investing is macro-consistent, high capacity and cost effective, and has long served as a performance reference for the equity industry. Cap-weighting does not challenge the potential irrationality of markets, yet the observation of many clients, investment consultants and observers is that it manages to produce better returns over time than many active managers. The strength of such passive investing highlights the importance of a single factor – beta – in explaining equity returns, and sets the bar for any alternative strategy to improve upon market returns.

Factor investing is by no means a new phenomenon, with research dating back to as early as the 1930s identifying “value investing” as advantageous within equity markets. The work of Graham and Dodd⁸ still has relevance when one considers the longevity of the premise and the regularity with which value investors such as Warren Buffet have cited this work as a forerunner of their own approach.

In the long period between the mid-1960s and mid-1990s we began to see many renowned academics propose ideas that have found their way into mainstream investing. Central to these are the efficient market hypothesis, the capital asset pricing model (CAPM) and the work of Fama and French⁹ in the 1990s, which more formally acknowledged the role of three central factors in driving equity performance: market, size and value.

The central focus of many equity portfolios has been on the market factor. Indeed, if the key long-term benefit of an equity allocation is to provide a risk premium over cash and fixed income, then it makes sense that capturing this premium should be investors’ priority, to ensure the longer-term success of an asset allocation.

Establishing the long-term level of this equity risk premium (ERP) has occupied many researchers and academics. By 1999, the work of Ibbotson and Sinquefeld¹⁰ had modelled the long-term ERP at 5–6%. However, in the early 2000s a new article,¹¹ which used a dividend discount model (DDM),¹² suggested that this level was actually lower, at around 2–3% ex-post.

The equity bear markets of 2000–02 and 2007–09, and the subsequent variability of fixed income yields and equity levels, have noticeably changed long-term ERP levels on a year-by-year basis, for both the Ibbotson Associates methodology and the DDM.

However, looking at the nominal returns available on developed and emerging market equities, and given the low interest rate environment, it is difficult to see ERP levels increasing significantly in the short to medium term (Exhibit 1).

Exhibit 1: Returns could be much lower than during the last three to five years

Asset class	US dollar expected return (%)	Expected volatility (%)
Equity		
Global equity AC	5.7	16.4
Global equity	5.2	16.0
US equity	5.4	15.8
Europe ex UK equity	4.2	20.9
Asia-Pacific, ex. Japan equity	10.2	22.1
Japan equity	5.6	18.0
Emerging market equity	9.5	22.5
Rates		
Global government bond	1.9	2.8
Global EMD - local currency	6.4	10.6
Credit		
Global Credit IG	2.9	5.8
Global Credit HY	3.6	9.5
Alternatives		
Commodities	2.2	16.8
Global property	5.9	18.1

Source: HSBC Global Asset Management, as at May 2017. Data in US dollars, unhedged. Any forecast, projection or target provided is indicative only and is not guaranteed in any way. HSBC Global Asset Management accepts no liability for any failure to meet such forecast projection or target

The low level of equity yields poses three potential issues as we consider how to add value within an asset allocation:

- Can we diversify the asset allocation to improve the risk-return profile – perhaps by adding granularity within asset classes, such as frontier markets in equity, emerging market debt or high yield in bonds?
- Can we consider alternative allocations such as infrastructure, real estate or private equity that can enable investors to earn an illiquidity premium?
- Can we decompose our existing allocation – for example, equity – into factors such that it enables us to increase the return/risk profile, or reduce the risk within the overall risk budget?

We will focus on the third option, a challenge that has preoccupied investors for decades. The generally held perception is that markets are not perfectly efficient, and exhibit excess volatility. The question is how to capture the exaggerated movement of stock prices to the benefit of a portfolio.

Introducing factor premia

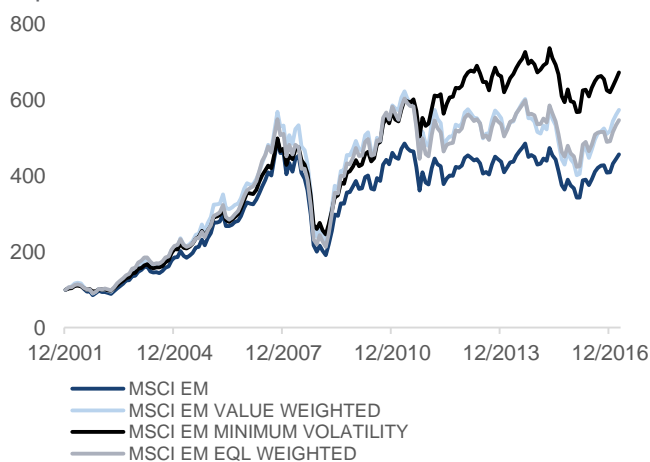
The academic sanction

The growth of “passive”

Capturing this market factor has led to the rise of index tracking funds based on market data over three decades. The first such fund was launched in 1974, but in the late 1980s indexing was still not common practice among the investment industry. However, the 1990s saw a shift in the asset allocation of many institutional mandates, from a “balanced portfolio” to one allocated out to individual managers within asset classes. This adjustment was also accompanied by a far greater focus on using benchmarking as a medium to measure performance, and the natural choice of benchmark for an equity portfolio was of course the relevant market index.

With this in mind, two paths emerge for managers seeking to allocate to equity. The first is to look to add additional value above the index and improve on the equity risk premium. Given the relatively low level of ERP available, even an extra percentage point can represent a 25% increase of return. Alternatively, fear of underperformance, or investment philosophy conviction, can lead an investor simply to “buy the index”. The active versus passive debate is driven by competing views about the efficiency of the market. If all information is known by all participants, then no opportunity exists to add value and indexing is the only route. However, a lot of academic work has been done on market efficiency and a plausible set of arguments, including those proposed by Robert Shiller,¹³ supports the idea of price inefficiency. This is of course necessary if one is to believe in the ability of a factor portfolio to outperform the market-cap index – that is, some inefficiency of price must exist for investors to take advantage of it.

Exhibit 2: Factor performance versus market capitalisation



Source: HSBC Global Asset Management, Bloomberg, MSCI Barra. All Indices are Total Return Indices denominated in US Dollars from 31 December 2001 to 31 March 2017. Any performance information shown refers to the past and should not be seen as an indication of future returns.

Do factors add value to a portfolio?

There are two clear strands in the existing literature: academic work supporting the existence of factor premia; and decades of research on investment style as a determinant of portfolio performance. Both support the assertion that systematic factor exposures have been key drivers of performance.

Factor investing, or “smart beta” to give it an oft-used marketing soubriquet, is not a new paradigm – it is the practical application of solid academic and investment concepts.

To gain a holistic understanding of factors, it is worth looking at their definition in more detail, especially since the investment industry has not yet agreed on a standard definition of the term “factor”. An approach to factor investing, and the choice of which specific factors to use, can differ from one asset owner to another.

We will also examine how factors impact performance outcomes, and how factor performance compares to a traditional market-cap approach.

What is a factor premium?

Some factors have been identified as having a long-term risk premium, meaning that over the long term they can offer a chance to add value above the market return. In equity markets, the most readily identified premia are: value, size, quality, momentum and yield. Low beta or low volatility could be added, but arguably should be seen as an anomaly rather than a factor premium, although investors have generally been comfortable accepting it as an advantageous factor to gain exposure to.

Unlike an active manager where the “skill” of the portfolio manager should be the source of excess return, systematic factor exposures can offer improved risk-adjusted returns, but based on academically-proven premia that drive equity market performance. In fact, many active managers have historically delivered factor exposure as an embedded part of the alpha they may have achieved – that is, their active management style was based on capturing factor premia. As investors began to measure the effects of portfolio style and factor bias more proactively, they better understood this and looked for ways to capture these factors more systematically and cost-effectively in an equity portfolio.

The implicit and explicit nature of factor exposures

Underlying long-term portfolio tilts

We have already observed that in seeking equity exposure many investors have been comfortable investing into an index strategy, safe in the knowledge that they will capture the relevant premium for equities on that market. However, the definition of “the market” in this instance derives from a price-based market capitalisation methodology that comes with inherent biases. The stocks whose prices increased by the most last year will have a higher weight in the index this year. This can lead to higher concentration in particular sectors but also in individual stocks.

This perspective ties into the academic thinking of Benjamin Graham, whose views were based on the observation that “in the short run, the market is a voting machine but in the long run it is a weighing machine”.¹⁴ Certainly, in the market environment of 2017 with frequent unexpected short-term volatility, Graham’s thinking makes a lot of sense. In the short term, prices are often influenced by irrational behaviour, popular or unpopular noise about a stock. However, in the long run the value of a stock will be recognised by the underlying financial performance of the company.

When we consider the key benefit of investing in an index – diversifying your single stock risk – it seems slightly counterintuitive that the methodology of the index construction could work against this. Price is also not fundamentally a metric of a stock, but is simply an expression of the attractiveness of the equity at a certain point in time. Attractiveness can be influenced by many measures and perceptions, and is prone to irrational behaviour. During the tech boom, Cisco traded at over 194 times price earnings,¹⁵ which seems absurd now but at the time represented the “new paradigm” of technology. This example illustrates how our “natural” benchmark is inherently biased to both large size and momentum. Accordingly, at points when the macro environment favours these factors it will perform strongly. Correspondingly, when the cycle turns, and as bubbles deflate, it will perform poorly.

Very few index investors have historically categorised their investment in an equity index as “a long-term tilt to momentum and large cap”. However, in effect this is what that allocation represents. Academics would suggest this is sub-optimal over the long term, in particular as only one of the two “tilts” is a rewarded premium. Exhibit 2 (previous page) shows the comparative performance of market-cap versus factors between year-end 2001 and May 2016.

In 2005, a paper¹⁶ made the case for a systematic rebalancing of portfolios and long-term portfolio allocations/tilts to value and small cap. The approach became codified within the Research Affiliates index series, which sought to use fundamental metrics to weight stocks.

This “fundamental indexation” approach appealed to investors seeking the simplicity of an index construction for their strategy. The fundamental index disconnected the index construction from price, using instead more fundamental metrics – such as contributions to gross national product (GNP) – to evaluate stocks more effectively relative to each other. In doing so, it enabled a clear expression of preference and explicit exposure to two rewarded factor premia: small size and value. This approach also articulated the benefits of systematically rebalancing a portfolio – effectively selling stocks that have risen and re-investing in those that have fallen – to keep the portfolio aligned to its fundamental metrics. Fundamental indexing was born, and shortly afterwards was termed “smart beta”, a name that has (sadly) stuck.

Fundamental indexing gave investors the opportunity to be rewarded for long-term portfolio tilts. It also had the advantage of low cost. By selecting an index format, it disconnected the delivery of outperformance from manager skill and allowed investors to engage with an index tracking fund manager to deliver the portfolio.

It is not, however, a panacea. While a well-researched and grounded case exists for value as a long-term premium, it will not outperform in all periods. In recent years, performance remained disappointing until the summer of 2016. This meant that a large number of investors who had swapped their momentum and large cap market-cap index exposure found that their small cap and value fundamental index exposure actually underperformed.

The attraction of traditional market-cap indexing is that it avoids relative performance surprises, which can be important when an investment committee reviews performance on a monthly or quarterly basis. The challenge for equity factor investors is that harnessing long-term premia requires a long-term mindset.

More factors and less risk

Dealing with unintended exposures

An index is not the only method available to harness factor exposure within a portfolio. Indeed, it is possible not only to engage with multiple factors but also to control the risk around this more proactively.

Globally, the past three years have seen a marked shift in the smart beta and factor investing market. Between 2005 and 2012,¹⁷ it was established practice for smart beta products to be delivered as an index – either by (or in combination with) a major index provider, or as a proprietary index. In the case of the latter, this was effectively a firm offering up their intellectual property in a highly transparent manner.

An index has two limitations: it may not always offer the flexibility to deliver the most effective product; and it can be awkward to express everything within a set of rules. Continuing research is crucial to retaining an edge and delivering an optimal strategy. That does not imply a need to make wholesale changes every week, but does mean being able to make updates and adjustments to deliver performance. It may also mean using proprietary models and optimisation techniques to deal with complex issues of risk and definition.

For reserve managers, there is a particular relevance to this as selecting an index to track has enabled a variety of institutions to use in-house teams to replicate the index passively and researchers to provide due diligence. For many, such an approach, allied to further research, has more than validated the case for having very clear factor exposure in the portfolio. However, these institutions must now address the thornier issue of: “How much of this can I do myself?”

The variety and breadth of factor-based strategies – be they index-based or not – has created a challenge for investors to find the most appropriate for their own portfolio aspirations. Delivering well-researched, proprietary insight and investing this appropriately requires a depth of research and an investing team, as well as significant cost in terms of risk models and data. In the challenge of how much can be internalised by an institution, there is no right or wrong answer.

For many of the larger reserve managers, a hybrid approach seems most likely. Where well-resourced teams with strong infrastructure and proven insights exist, there is no need to reinvent the wheel. Having said that, covering all factors across all regions can in many cases be a challenge too far for a single internal team.

What we have seen among reserve managers is that, over the last decade, as well as embracing market cap indexing, some have also adopted fundamental indexing (for a value bias) and low volatility/minimum volatility indices and strategies. Some are now taking a step further and engaging with the challenge of creating a “multi-factor” allocation.

Multi-factor approaches: dealing with unintended risk and factor drift

Several recent surveys¹⁸ have shown that the uppermost concern of investors who have adopted smart beta/factor solutions is that of an unintended factor bias. This has stemmed from the realisation that stocks do not naturally fit within a factor or style box, and that market cycles can change the composition of a portfolio. Many transparent indices lack a crucial element of control as they are not in a position to add modelling or optimisation to their process to remediate a drift.

A combination of factors can offer the opportunity to decrease the performance extremes of a single factor allocation. However, factor correlation can vary noticeably as we move through the cycle, and this can exacerbate risks but also fundamentally change the balance within a multi-factor model.

The five key factors that are often employed within an effective multifactor equity portfolio are value, quality, momentum, volatility and size. An optimal portfolio can be customised by taking a high or medium, or possibly low, exposure to each of these factors.

However, a number of elements need to be addressed to ensure these exposures are correlated correctly through asset selection. These include:

- Adopting the right factor methodology and taking advantage of factor composites and sub-components
- Using an effective weighting system that identifies and provides greater weight to principal components
- Ensuring data is statistically independent to avoid correlation contamination
- Avoiding high stock-specific risk by using alternative methods to weight stock selection

By ensuring that the above features are considered, investors can avoid unintended factor risks, which may help to understand performance inconsistencies caused by specific factor exposure.

Low volatility approaches

Balancing portfolio risk with liquidity constraints

As mentioned earlier, some reserve managers have taken exposure to low-volatility portfolios. Here, the terms “smart beta”, “factor” and “style” are often used interchangeably.

While smart beta undoubtedly addresses a large number of investment indices and funds that seek to take advantage of factor premia, it also focuses on other strategies – such as minimum volatility and maximum diversification.

These can be described more accurately as portfolio construction techniques, since both seek to create a portfolio that takes advantage of a point on the efficient frontier. As such, neither explicitly looks to benefit from factor exposure.

Considering the appeal of low-volatility portfolios to investors, the objective is typically to achieve the same return as the market portfolio (hence, why it fits on the efficient frontier), but with around 85% of the volatility. This has the benefit of reducing the risk of an equity allocation within the overall risk budget.

The portfolio takes advantage of minimum variance portfolio construction, in effect an optimisation that seeks to find the lowest risk portfolio to deliver the same return as the market.

The investment outcome to achieve long-term, superior risk-adjusted returns can be of particular interest to reserve managers that have a stronger objective to balance portfolio risk in line with liquidity constraints with a lesser focus on enhancing returns.

In Exhibit 3, if we look at the performance of the Minimum Volatility Index (MSCI in this instance) and plot it against its market capitalisation counterpart (MSCI World), it becomes clear that over this period the minimum-volatility strategy has delivered a lower volatility over time as well as a better return.

However, it is worth noting that this longer-term picture does disguise periods of significant underperformance – in particular, during episodes such as the taper tantrum in 2013 and the value rally of the second half of 2016. As such, despite employing a low-volatility strategy, an institution could find themselves having to justify several quarters of sub-benchmark performance. Clearly, this will not be an issue if volatility reduction is key, but if return and risk require balancing then the solution may require more customisation.

Exhibit 3: Performance of MSCI Minimum Volatility Index (World) versus MSCI World



Source: MSCI; Bloomberg. 1 January 2003 to 31 March 2017. Any performance information shown refers to the past and should not be seen as an indication of future returns.

Conclusion

Key takeaways for reserve managers

In conversations with our institutional clients, including reserve managers, we have seen an increasing interest in learning about the details of factor investing, and we believe this focus will only intensify. Investors' main motives are to explore new drivers for portfolio diversification, to increase portfolio transparency and risk management, and to enhance investment returns.

However, we are well aware that so far only a few market participants, namely public pension funds and sovereign wealth funds across North America and a few in Europe, are harnessing the benefits of a factor equity approach.

There are many reasons for this, the main one being a lack of fundamental investment conviction, which keeps asset owners from fully committing to this "new" style of investment management. Yet even for those reserve managers whose investment principles would allow for a factor equity approach, other reasons come into play.

Many have already taken a big step in changing their conventional investment behaviour by moving into passive market-cap equity strategies, driven by the need to enhance returns in this low-yield environment and to diversify away from traditional government bonds, as well as from other high-quality and liquid fixed income investments. We could therefore think that factor investing was a natural progression after this.

In fact, the move to allocate assets into factor equity portfolios is not as straightforward as one might assume. The non-standardised investment framework of a factor equity approach – and the lack of benchmarks in particular – goes against the well-established institutional nature of reserve managers.

In addition, the construction of factor equity portfolios would come with increased operational complexity and a need for new risk management tools. Such a change would require a great deal of communication with internal stakeholders to explain an investment approach that differs quite significantly from traditional academic practice, an undertaking that could take many years for a reserve manager.

As much as academic research and literature can prove that factor premia exist, potential investors need to be aware that a factor approach isn't a guarantee to achieve superior risk-adjusted returns across all market cycles.

It is true that over the long-term academic research has shown that a factor approach may achieve superior risk-adjusted returns compared to a traditional market-cap investment, but we also want investors to bear in mind that factors have been shown to perform differently in different market regimes, which can lead to quarters or even years of underperformance. This makes it crucial for investors to determine their investment horizon and to agree on a clear definition of the factors to which they want exposure.

Investors also need to understand that a factor investing approach should not be perceived as a tool to achieve substantial outperformance versus a market-cap index. Excess returns are usually quite marginal, depending on the chosen tracking error, but they can make a substantial difference to overall equity investment returns over the long-term.

As outlined in this paper, despite operational and practical hurdles, there are clear benefits to following a factor approach. Not only can it lead to enhanced returns, but it can also enable investors to manage investment risks with more accuracy and make the overall investment process more efficient.

Specifically for equities, a factor approach can give a reserve manager a more granular understanding of the underlying risk and return of their portfolio. It can also help investors determine whether the under- or outperformance of the equity portfolio is driven by factors such as momentum, size, quality, value or yield. Increased transparency of the underlying risks and returns of a portfolio can be very powerful.

However, quantifying factor exposures and risks driven by factors is only the first and simplest part of the equation. Converting those parameters into investment decisions is far more complex. Investors must begin by quantifying factor risks – a key pillar of the overall investment process.

Next, by having a holistic understanding of factor exposure in their equity portfolio, they need to build a more developed investment process, able to support long-term strategic allocation decisions as well as short-term tactical trades. In particular, such a process will help the investment team translate their market views and convictions into investment decisions in a more granular way.

Taking an example, if the investment team of a central bank believes that Asian small caps will be the key drivers of growth in Asia, a factor-based framework can help adjust the equity portfolio to reflect these views.

This also benefits the overall risk management framework, where the in-house risk management team at a reserve manager can clearly explain to internal stakeholders which factors influenced investment outcomes and portfolio volatility. An obvious sign of greater risk control is that, where performance deviates from a traditional market-cap approach, this deviation can be explained with greater detail and transparency.

Ultimately, the use of a factor approach in an equity portfolio will depend on the individual circumstances of each reserve manager. Investment needs and objectives vary from one reserve manager to another, who might therefore look at factors in different ways.

Some may be drawn to the increased transparency of portfolio returns and risks, while others may prefer the idea of achieving long-term, superior risk-adjusted returns, and others still might see factor strategies as an asset class for diversification purposes.

The reasons for applying a factor approach can be manifold, and this paper has aimed to provide an overall understanding of such an approach and its benefits.

As the industry continues to progress in its exploration of factors, it is worth keeping a close eye on factor investing developments.

In an environment where markets can change quite rapidly, and are expected to continue do so over the next few years, reserve managers can gain from questioning and reviewing traditional investment concept, and it is worth considering if and how factor investing may help them face some of their investment challenges.



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Before joining HSBC Global Asset Management in 2015, Michael had a twenty-five-years career in the official sector, for the most part at the Bank of England, but also at the International Monetary Fund where he was Private Secretary to the Managing Director, Michel Camdessus, between 1997 and 2000. At the Bank of England, he was Head of Sterling Markets Division, responsible for the implementation of monetary policy and liquidity-supplying operations to the banking system in the Global Financial Crisis, between 2007 and 2009. From 2009 to 2015 he was Head of Foreign Exchange Division and Reserves Management, during which time the UK's foreign exchange reserves were doubled as part of the policy response to the challenges of the post-crisis period. At the same time, he was a member of the Secretariat of the Monetary Policy Committee, Chairman of the London Foreign Exchange Joint Standing Committee, and a member of the Markets Committee of central banks at the BIS.



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