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**Active bond returns
- powered by factors**

A perspective on active engagement

Pension reform paves the way for target-date funds in Mainland China

Low volatility anchoring

Equal weighting in sector portfolios

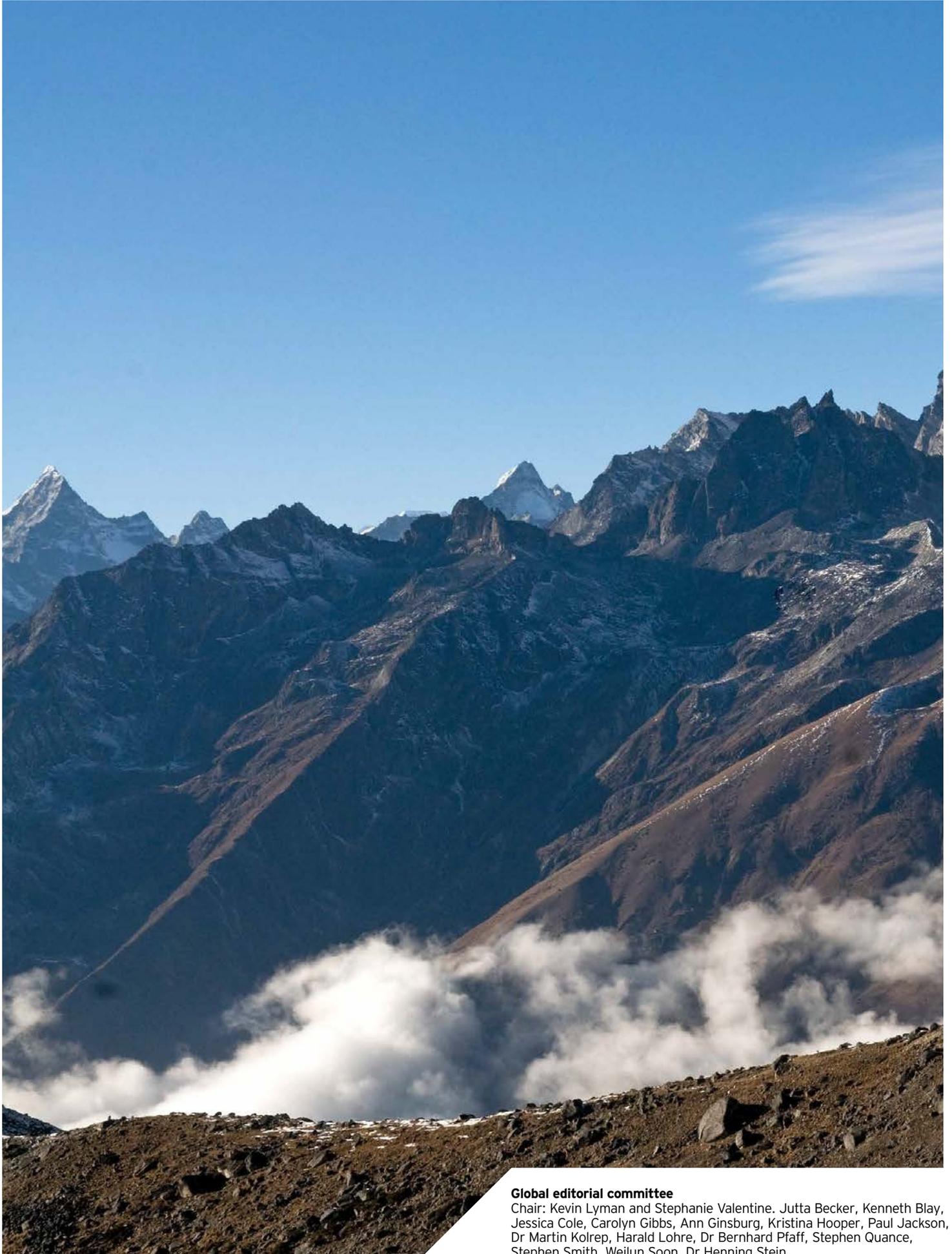
Risk & Reward

Research and investment strategies



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For Invesco, factor investing is more than a specialized way of managing equities. It's a distinct asset management philosophy based on the belief that factors, rather than individual securities, are powerful portfolio building blocks.

Invesco has more than 30 years' experience managing factor strategies for clients around the world. In this issue, our fixed income analysts show how the factor approach can be applied to bonds. In fact, we argue that bond strategies, even if they do not explicitly use the factor approach, do so implicitly since factors are such a ubiquitous element of investing.

We also turn our focus to pension reform in China, arguing that the development of a true private pension market may offer new opportunities. Of course, we intend to be among the firms helping clients gain from the expected market growth. We're convinced that our long history in the region and strong, experienced team on the ground in China could prove to be a meaningful competitive advantage on behalf of clients.

In our continuing series on ESG, analysts from our Henley Investment Centre present a comprehensive study with a number of case studies illustrating their approach to the topic and showing how important ESG is for them.

Finally, we deal with low volatility anchoring and equal weighting in two quantitative and statistical articles. Our study on low volatility anchoring investigates whether the minimum variance portfolio is still the gold standard when it comes to exploiting the low volatility anomaly - and concludes that a less rigid approach could lead to better results. And in our examination of equal weighting, we present an array of statistics showing that, for sector portfolios in particular, equal weighting has numerous advantages over the traditional cap weighted approach.

We hope you enjoy this latest issue of Risk & Reward.

Best regards,

A handwritten signature in blue ink that reads "Marty L. Flanagan". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

Marty Flanagan
President and CEO of Invesco Ltd.

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Active bond returns – powered by factors

By Jay Raol, PhD, and Stephen Quance



In brief

We have often argued that factor investing is by no means confined to equities. The concept is applicable to virtually all asset classes. In this first study in a series of papers designed to help investors better understand the implications of factor investing in fixed income, we apply a factor strategy to bonds and argue that, even when a bond strategy is not explicitly labelled a factor strategy, its factor exposures are what really count and drive the strategy's active performance.

Asset owners and investors are increasingly incorporating factor analysis when analyzing their portfolios. Here, we apply the same kind of analysis to active fixed income strategies - and the results are quite telling.

Morningstar's 2018 midyear report, which tracks active and passive performance across US equity and bond funds, shows that, while only 36% of active equity managers beat their passive benchmarks over the trailing one, three, five and 10-year periods ending in June 2018, more than 70% of bond fund managers beat their passive indices.¹ This data seems to support the view that active investing "works" in fixed income.

But where is this excess return potential coming from? Academic research and investor surveys support the intuition that fixed income managers employ factors - either implicitly or explicitly. Invesco Fixed Income's own research corroborates this view: our analysis shows that most portfolios are exposed to factors even though none follow an explicit factor approach. This factor exposure explains a significant proportion of active returns in bond portfolios. For example, we see evidence that the value factor often helps explain excess returns (value bonds are those that have lower prices compared to similar peers).²

Investors appear to understand this too. In a recent survey by DWS,³ they cited forced sales after ratings downgrades of formerly high-quality bonds (commonly called "fallen angels") by institutions such as central banks, commercial banks and insurance companies as a reason why active management is able to outperform benchmarks. This finding is formalized in academic literature; Wang, Zhang and Zhang (2017)⁴ found that mutual funds provide liquidity to insurance companies during forced bond sales and that this is associated with excess returns. This phenomenon is part of what we capture with our value factor in fixed income.

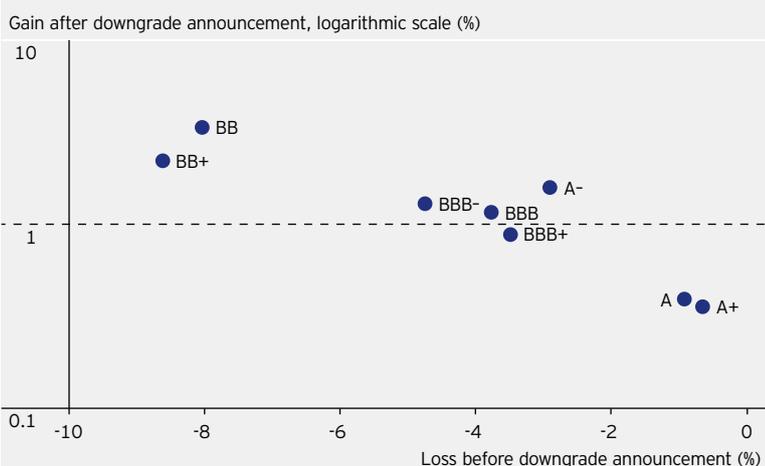
An initial example: rating downgrades illustrate the value factor at work

Invesco Fixed Income's research shows that this phenomenon occurs at most credit rating levels. Figure 1 shows bond returns before and after a

Risk transfer gives rise to factors

The relationship between risk and return is at the heart of factor investing. This risk transfer between market participants with different risk appetites, as predicted in Merton's Intertemporal Capital Asset Pricing Model, naturally gives rise to factors.⁶ In this framework, the liquidity provided by investors in the case of fallen angels is a risk transfer from more risk-averse to more risk-seeking investors. Investors may not realize that they are articulating the benefit of a value factor as a reason for active management to outperform a benchmark - a fact that motivates us to look for other factors that might drive investment performance.

Figure 1
The risk and return surrounding downgrade announcements



The figure shows the return of bonds relative to sector and maturity-matched peers 12 months prior to a downgrade announcement (x-axis) and the return after the downgrade announcement (y-axis). Source: Bloomberg Barclays US Investment Grade Credit and US High Yield Credit Indices, Invesco calculations, from 1 January 2000 to 30 June 2018. **Past performance is not a guide to future returns.**

downgrade announcement. Bonds tend to lose value before a downgrade announcement and to recover afterwards. While a second downgrade is more likely to occur after the initial downgrade,⁵ it is by no means certain, and it is more likely in recessions. In other words, while some bonds may be subject to further downgrades, bonds on average tend to recover. In our view, this risk-return tradeoff is the basis of factor investing.

The median factor manager relied on liquidity, carry and value to outperform the benchmark

Our analysis covered active manager returns in the core bond fund space to understand whether factors could help explain returns in excess of the benchmark. We sampled 65 investment managers representing the largest managers in the Lipper

In our view, this risk-return tradeoff is the basis of factor investing.

Table 1
Active management returns in the Core Plus peer group

	Net information ratio	Gross information ratio	Gross active return (%)	Tracking error (%)
75 th percentile	0.13	0.21	0.97	1.50
Median	0.04	0.13	0.34	1.12
25 th percentile	-0.03	0.08	-0.15	0.85

Source: Bloomberg L.P., Invesco calculations from 1 January 2007 to 30 June 2018. **Past performance is not a guide to future returns.**

Core Plus peer group over the period from 1 January 2007 to 30 June 2018. Table 1 shows summary statistics for the funds considered. "Net IR" refers to the information ratio, or the annualized net-of-fee active return per unit of tracking error; "Gross IR" is the gross-of-fee information ratio. The gross active return is the annualized return of the fund over its benchmark in percent. The tracking error is the annualized standard deviation of the gross active return.

Factors drove most of the outperformance versus benchmarks

Table 1 supports the idea that active managers often beat their benchmark. To understand the drivers of these excess returns, we regressed factor returns against the active returns. For each fund, we aggregated monthly total returns (price returns plus any dividends) and added back stated manager fees to approximate gross monthly returns. Each fund's returns were then subtracted from the benchmark returns to calculate "active" returns.

After calculating each fund's active return, we regressed factor returns against active returns. We utilized a robust form of regression using a bootstrapping method to reduce factor exposures that could be spurious, insignificant or transitory. Several factors were considered, including duration, carry, value, quality and liquidity.

We used the Bloomberg Barclays US Treasury Index total return to represent duration return and the duration-hedged return of the Bloomberg Barclays US Credit Index to evaluate carry. The duration-hedged returns to liquidity, quality and value are discussed in more detail in Raol and Pope (2018)⁷ and are described in the box below.

Factor exposures explained 66% of excess return variations

Figure 2 shows the regression results for the median manager. It shows the average beta, or correlation coefficient, between the factor and the manager's active return. The median manager had positive exposure to carry, liquidity and value. There was no

Figure 2
Factor betas of the median manager



Source: Bloomberg L.P., Invesco calculations from 1 January 2007 to 30 June 2018.

significant quality exposure and negative exposure to duration. This means the majority of managers were able to beat their benchmarks by holding older, smaller issue size bonds with lower ratings and longer maturities than the benchmark average (large exposures to the liquidity and carry factors). To a lesser extent, managers held securities that were cheap relative to their sector and rating peers (value exposure). Managers appeared to allocate very little to US Treasury bonds and high-quality credit. On average, across the entire peer group, factor exposures explained 66% of the benchmark excess return variations - a substantial portion.

Factor exposures explained 66% of the benchmark excess return.

Invesco Fixed Income credit factor definitions

We found four factors that help explain credit returns across bonds and investment environments:

Carry	Quality	Value	Liquidity
The carry factor captures the excess return resulting from higher yielding bonds regardless of credit rating. In this context, it is synonymous with the concept of a credit premium, but a carry factor can be more general in other contexts.	The quality factor explains the higher risk-adjusted returns associated with holding low-volatility bonds and is widely observed in the academic literature. ⁸ These bonds typically have short maturities and low default risk as measured by their ratings. The quality factor is a characteristic of securities that tend to be good stores of value during times of market stress since they have low volatilities.	The value factor explains the excess return obtained by holding assets that are priced at a discount relative to similar securities. Since a bond's price is a function of its default risk, a natural definition is to identify bonds priced at a discount relative to their implied default rates. These factor returns include transaction costs of 10-40 basis points, depending on the maturity and rating of the bond.	The liquidity factor explains the excess risk and return associated with holding illiquid bonds and has been well researched in the literature. ⁹ The liquidity factor is defined by older vintage bonds that are small in issue size relative to large, newly issued bonds.

These results have several interesting implications. First, they show that investors likely already have exposure to factors in their portfolios - either implicitly or explicitly. Once we acknowledge the role factors play, we can take control by exploring the ramifications:

- To which factors should investors have exposure?
- How much factor exposure should they have?
- How much should they pay for factor exposure?

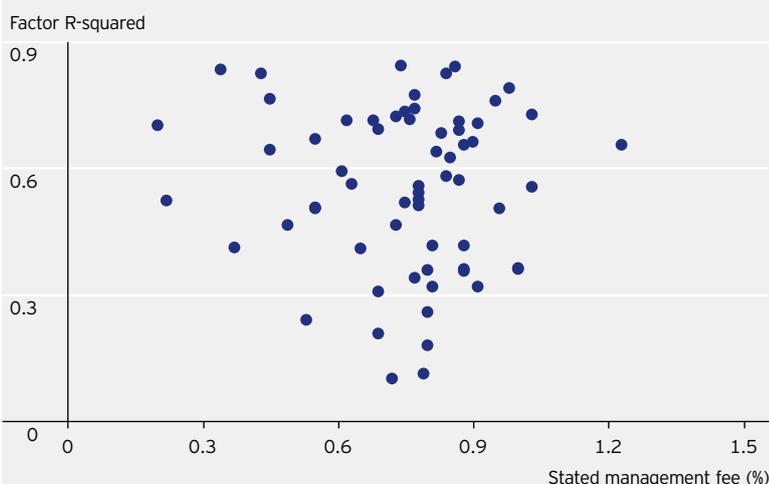
Figure 3 plots each fund's R-squared against its management fee. We see that no clear relationship emerges. In an ideal world, higher fees should be associated with funds that demonstrate consistently high alpha beyond factor exposure. Funds with consistent factor exposure but little alpha should likely cost less than high-alpha funds but still be more valuable than strategies that do little more than replicate the market. Yet the reality is different.

Conclusion

With a clear understanding of a strategy's factor exposures, alpha generating ability and costs, investors have more information to help determine the likelihood of achieving their desired result. Fixed income factor strategies can be utilized to complement other strategies through explicit factor exposures, replace inefficient or cost-ineffective strategies or diversify the overall portfolio. We will explore these issues further in upcoming articles on factor investing in fixed income.

Figure 3

Fees and factors - no clear relationship



Source: Bloomberg L.P., Invesco calculations from 1 January 2007 to 30 June 2018.

About the authors



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Jay Raol is a member of the macro research team at Invesco Fixed Income. In his role, he works on macroeconomic models for asset allocation and fixed income investing.



Stephen Quance

Director of Factor Investing, Invesco

Stephen Quance promotes the global factor initiative by supporting clients, aiding research, setting strategy, refining operations and increasing education both internally and externally, primarily in the Asia Pacific region.

Notes

- <https://www.morningstar.com/blog/2018/08/23/actively-managed.html>.
- For a more detailed explanation of Invesco Fixed Income factor definitions, see Raol, J. and Pope, S. (2018), "Why should investors consider credit factors in fixed income?" Invesco Working Paper 2018.
- <https://etf.dws.com/LUX/ENG/Download/Brochure/79382ba7-e035-4e69-b085-dff2232528c7/Passive-Investing-Research-2018-2336.pdf>.
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- For example: Frazzini, Andrea and Pedersen (2014), "Betting Against Beta", *Journal of Financial Economics*, 111, 1-25. Low-volatility bonds are typically characterized as bonds with short maturities and low default risk.
- Bao, Pan and Wang (2011), "Liquidity in Corporate Bonds", *Journal of Finance*, 66, 911-946.

“Your fixed income portfolio may have more factor exposure than you realized.”

Interview with Jay Raol, Stephen Quance and Shane Gallagher



Jay Raol, Senior Macro Analyst,
Invesco Fixed Income



Stephen Quance, Director of Factor Investing,
Invesco



Shane Gallagher, Client Portfolio Manager,
Invesco Fixed Income

Risk & Reward spoke to Invesco's Jay Raol and Stephen Quance, authors of the bond factor study (article) in this issue, as well as senior associate client portfolio manager Shane Gallagher, about factor investing in the fixed income domain.

Risk & Reward

Why do you think it is important to look at fixed income portfolios through a factor lens?

Stephen Quance

We see factor investing as a global trend that marks a permanent shift in how assets are managed. One reason is that analyzing factor exposure in a portfolio is informative and useful. This applies to fixed income markets just as it does to equities. In our article, we looked at a broad range of US core fixed income portfolios and found that, whether explicitly targeted or not, factor exposures drove much of their performance. Indeed, factors may have been behind much of the average fixed income manager's outperformance over the last ten years. In other words, investors are factor investors whether they know it or not. Looking at portfolios through a factor lens can help increase transparency, identify existing risk exposures and clarify manager performance.

Risk & Reward

What are fixed income factors?

Jay Raol

Investment factors are directly observable characteristics of securities. They can be used as part of live strategies to help investors achieve particular outcomes. We believe that every factor must be backed by a reasonable theoretical rationale and confirmed by empirical analysis. For example, the value factor can identify bonds priced lower than their peers. All else held constant, lower prices imply higher returns - this holds true for bonds as well as other assets. But we have identified additional fixed income factors: the carry factor explains risk-adjusted excess returns from holding higher yielding bonds. The liquidity factor explains risk-adjusted excess returns from holding less-liquid bonds - often older vintage, with smaller issue sizes. The quality factor explains risk-adjusted excess returns from holding low-volatility bonds, which are typically of short

maturity and have higher ratings. Each factor helps explain the risk and return associated with holding different types of bonds.

Risk & Reward

How do typical fixed income portfolios stack up in terms of factor exposure?

Jay Raol

We found that the median fixed income manager in the Morningstar universe was exposed to multiple factors. For each fund in the universe, we regressed factor returns against active returns, taking into account our value, carry, liquidity and quality factors. We observed that the median manager had materially positive exposure to carry, liquidity and value. The majority of bond managers were able to beat their benchmarks, at least partially, by holding older, smaller issue size bonds with lower ratings and longer maturities compared to the benchmark average. To a lesser extent, managers held securities that were cheap relative to their sector and rating peers. On average, we found that factor exposures explained 66% of bond managers' excess returns.

Risk & Reward

What do these findings mean for fixed income investors?

Stephen Quance

Investment decisions require more and more transparency and information. At Invesco, we classify investment approaches into three categories, or "pillars": fundamental high conviction security selection (aka, alpha-seeking), market weighted and factor investing. There are advantages and disadvantages to each, so understanding what you have is useful. For example, an investment fee ought to reflect the value provided to the client as well as the cost associated with providing that value. Therefore, we believe funds with consistent factor exposure, but little alpha, should cost less than a high-alpha fund. But they should cost more than strategies that only replicate a market index. However, our research finds no clear relationship between factor exposures, alpha and fees. Understanding an existing portfolio's factor tilts helps us understand whether it makes sense to replace part of the portfolio with a new strategy or whether a new strategy can complement existing ones.

Risk & Reward

What do your findings suggest as to how fixed income investors could approach their portfolios?

Shane Gallagher

We encourage investors to consider the current factor exposures of their portfolios and, where appropriate, adjust them to better align their risk profile with return objectives. Alpha can be a key component of investment returns, as evidenced by the 34% of returns not explained by factor exposure. The same is true for low-cost strategies that replicate an index. However, a factor framework can add value by identifying some of the risks in a portfolio and providing a way to adjust them, if warranted. Not only could the factor lens result in outcomes more suited to an investor's objectives, it can also increase transparency, help explain portfolio movements and clarify an active manager's skill in an efficient, scalable and cost-effective way.

Risk & Reward

How can factors be employed in portfolios? What are the benefits of single- versus multi-factor strategies?

Jay Raol

The answer depends on what investors are trying to achieve and what constraints must be respected. Since such a large part of excess return is explained by factors, it seems only natural that factor strategies could play a central role in a portfolio. A single-factor solution can be used to complete a portfolio that might be lacking exposure to a desired factor. For example, additional exposure to the quality factor could balance the natural carry and value tilts of the median active manager. However, single factors can go through long periods of outperformance and underperformance relative to the benchmark. Therefore, a multi-factor solution may be more desirable where investors are seeking long-term exposure to all factor premiums in an efficient and risk-controlled manner.

Risk & Reward

Thank you very much for your time.

A perspective on active engagement

How the Henley Investment Centre approaches Environmental, Social and Governance (ESG) engagement

By Cathrine De Coninck-Lopez, Amy Kelly and John Pellegrini

In brief

ESG plays a crucial role in all the investment processes of our Henley Investment Centre. We describe our core beliefs - most notably our preference for engagement over exclusion - and show how we implement them in equity portfolio management, as well as illustrating our ESG engagement with three case studies.

Active ownership is defined as the use of the rights and position of ownership to influence the activities or behaviour of investee companies.¹ At Invesco's Henley Investment Centre, we believe that active ownership goes hand in hand with active investing. As such, engagement on behalf of the clients whose capital we invest is a central tenet of our investment process.

Responsible investment has grown from niche exclusion-led approaches in the mid-90s to a mainstream part of the professional asset management world today. Globally more than USD 22 trillion, or a quarter of professionally managed assets, are held within responsible investment strategies.² Yet the landscape of responsible investment is diverse. Responsible investment approaches form a heterogeneous mix, ranging from focusing on the core investment process to ring-fenced approaches for funds and mandates. While there is substantial overlap, the former include the pursuit of ESG integration and active ownership while the latter revolve around exclusionary or best-in-class screens, thematic or impact investing strategies. All of these approaches will have a spectrum of outcomes, some more financially focused and others with greater environmental and societal outcomes. Within Invesco's Henley Investment Centre, our ethos is engagement - using the shareholder power we hold on behalf of our clients to influence corporate behaviour at the highest levels.

Our approach to company engagement promotes responsible ESG practices as a cornerstone for the long-term financial health of the businesses in which



we invest. As we promote good business practices in the investee companies, we in turn offer our clients the opportunity to benefit from the potential share price increases that improved ESG ratings and outcomes can provide. Our investment processes thus fully align ESG considerations with active ownership.

Our investment processes fully align ESG considerations with active ownership.

Research commissioned by the Principles for Responsible Investing (PRI) investigated the link between investor engagement and value creation. The report found that engagement on ESG topics creates long-term shareholder value, as communication between investors and companies enables the exchange of information, promotes learning dynamics and allows political benefits to be maximized.³ As active investors, we ascribe wholeheartedly to this view.

Engagement over exclusion

According to the biennial Global Sustainable Investment Review, the most popular form of responsible investment measured by assets under management comprises negative screening and exclusion. Certainly the elimination of companies or sectors deemed to be 'sinful' is one of the best-known and most commonly cited forms of responsible investment. Simple in theory, though arguably more complex to implement, this strategy involves avoiding companies or countries that do not satisfy specific ESG criteria. This can mean, for example, the complete exclusion of companies in the alcohol, tobacco, gambling or armaments sectors or the exclusion of countries due to human rights breaches or environmental standards. Such exclusions can derive from a legal requirement or one stipulated in the investment principles of an organization. Exclusion-led mandates offer investors choice, and this is a choice we have the capability to deliver. But we stress that they also have their limitations.

Excluding investments in a specific sector sounds straightforward, but does this entail merely avoiding the securities of companies listed within the sector or does it extend to those with revenue exposure to that particular sector? If the latter, what threshold is imposed? What level of monitoring is required to ensure screens remain relevant? And what of indirect exposure via supply chains or logistics?

The use of exclusion-based models could fail to align investment decisions with the best interests of clients if, for example, it led to the avoidance of capital generating investments. Instead, where companies, sectors or countries have poor ESG ratings, we view engagement with investee companies as the most effective way of securing mutually beneficial outcomes for both our clients and investee companies. We believe that working on the basis of engagement or dialogue, rather than exclusion, is better aligned with both achieving investment performance objectives and improving ESG performance.

The power of momentum

Given our views on the importance of engagement over exclusion, the concept of ESG momentum, or improving ESG performance over time, is particularly interesting. We find that companies that are improving in terms of their ESG practices may enjoy better financial performance over the longer term. We see engagement as an opportunity to encourage this continuous improvement. Accordingly, we deem investing in companies that demonstrate a commitment to improving and/or enhancing their ESG performance a more beneficial approach than simply excluding those with negative ESG ratings. Dialogue with investee companies is a core part of the investment process across our regional equity investment desks. As we engage with companies willing to enhance and improve their ESG-related practices, we can in turn expose our investors to the share price performance improvements we anticipate with ESG momentum.

A strong voice

Since engagement with companies offers opportunity to encourage continuous improvement, dialogue with investee companies is a core part of the investment process within our Henley Investment Centre. However, as the PRI acknowledges, "the level of corporate access... long-term relationships with key corporate actors, and the presence of strong 'buy-in' from top management," are key factors in the success of ESG engagement.⁴ In other words, engagement alone is not enough. Investors must have strong relationships with investee companies, excellent access to company management and executives who are committed to improving the ESG agenda in order to see engagement succeed as an ESG strategy.

Investors must have strong relationships with investee companies.

We have had this philosophy of dialogue for many years. Our investment teams take large investment stakes and are often among the major shareholders in a company, particularly in the UK and Europe. We are in many cases among the top minority shareholders in Asian companies, where founder-ownership levels are traditionally higher than in Western markets. As such, we often participate in board-level dialogue and are instrumental in giving shareholder views on management, corporate strategy, transparency and capital allocation, as well as wider ESG aspects. In this way we use the collective power of the clients we represent to speak for the best long-term interests of the company and in turn promote the best interests of our clients.

As high-conviction investors, we look at each sector and company individually and consider materiality of ESG issues at a fundamental level. Where we consider an issue to be of material importance, we pay attention to improvements in performance over time, quantifiable metrics and transparency of approach. These topics form the basis of our analysis and engagement activities. While there

may be nuances within sectors and companies, the high-level issues that we believe are of material importance are:

- Business ethics
- Capital allocation
- Carbon emissions
- Corporate governance
- Data privacy
- Health and safety
- Labour relations
- Product characteristics
- Water, waste and biodiversity

All company engagement is proportionate and reflects a number of relevant factors, such as the size of holdings, length of holding period and significance of ESG issues. Given our active asset management culture, engagement with those companies in which we invest on our clients' behalf is very important and a priority for all equity fund managers. Encouraging high standards of corporate governance, positive social behaviours and environmental considerations within those companies is, we believe, fundamental to the investee companies achieving long-term success and positive outcomes for our clients. In our view,

this is a core part of our responsibility to clients, as stewards of their capital. In 2018 alone, our investment teams engaged in dialogue on ESG topics with 850 companies.

Dedicated resources

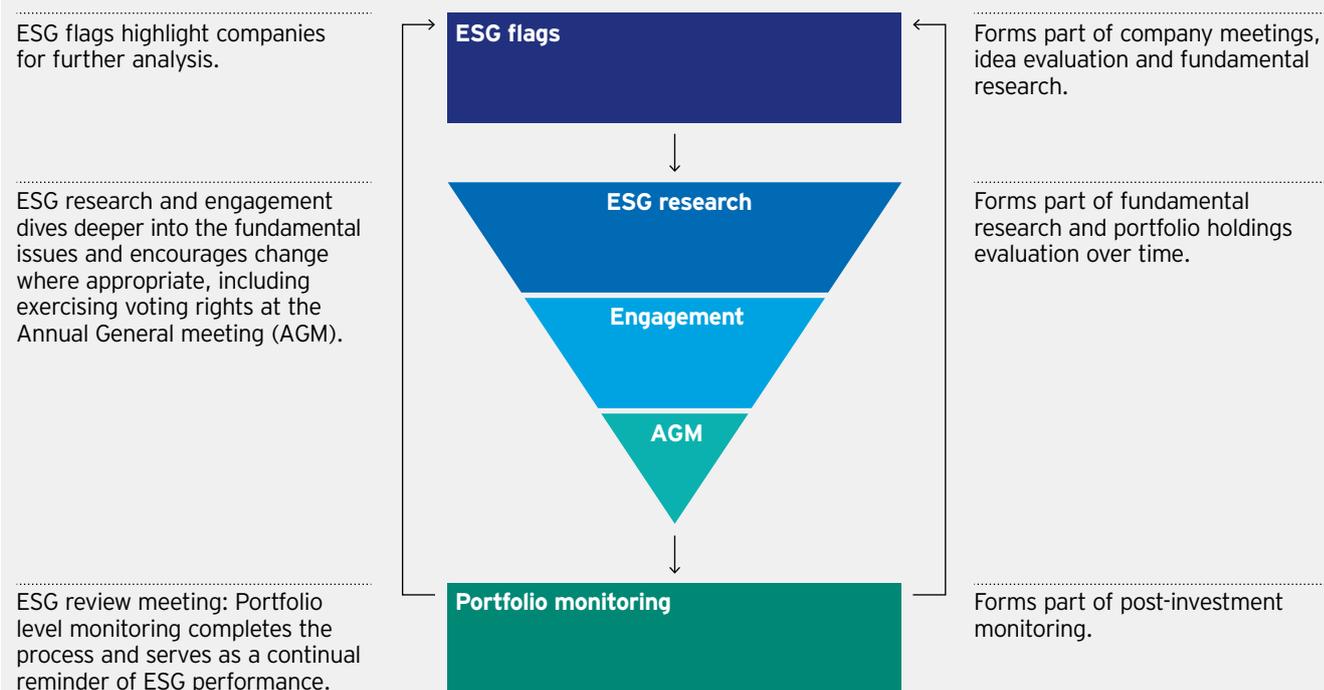
Our dedicated ESG team produces proprietary research which supports targeted ESG-related engagement, and the Henley Investment Centre's Head of ESG provides formalized ESG portfolio monitoring. This is a rigorous semi-annual process and includes a meeting with the regional team fund managers and analysts to review representative portfolios from an ESG perspective, ensuring a circular process for identifying flags and monitoring improvements over time. The team's efforts are supported by a number of systems, such as Sustainalytics, ISS and more.

Our dedicated ESG team produces proprietary research.

In 2018 alone, our investment teams engaged in dialogue on ESG topics with 850 companies.

Our Chief Investment Officer has ultimate oversight of the investment centre's ESG approach. Our ESG investor group is chaired by our Head of ESG and is made up of champions from each investment team. The ESG champion is a representative of the individual investment teams that feed into the overall ESG approach and areas of interest for further analysis.

Figure 1
An overview of the Henley ESG process



Source: Invesco. For illustrative purposes only.

The role of this group is to help facilitate dialogue and share insights from across asset classes and regions within the investment centre.

Training is an essential part of our commitment to ESG integration and our ability to keep abreast of the rapidly evolving responsible investment landscape. Our continuing personal development (CPD) training programme also includes ESG modules.

Integrating ESG into our investment processes

To support the initial screening of a company's ESG ratings and to assist with ongoing monitoring, we use both internal proprietary resources and external providers. These systems and personnel work together to flag potential and existing ESG issues, which we as investors can investigate, engage on with companies and work towards resolving (figure 1). Where these flags are raised, we target ESG research and dialogue towards the relevant companies. This is carried out directly and in partnership with our dedicated ESG team in Henley.

ESG in practice: three case studies

Demonstrating a committed and effective ESG policy is fast becoming a requirement for global asset managers. To best demonstrate the power of an active, engagement-led strategy, we explore three real investment examples from across our regional investment desks:

Case study 1:

Environment - fuelling the energy transition

As the energy sector tends to score poorly in ESG screens, we show how active engagement can help support meaningful change in the industry.

The integrated oil & gas sector is enemy number one on many ESG exclusion lists. Environmental concerns surrounding the sector are notable and well-founded and, as such, companies often screen poorly against numerous ESG criteria. Our Henley-based European Equities team has significant exposure to the sector, including a Norwegian oil & gas firm which is positioned to make a positive contribution in an environment of transition to a lower-carbon world.

The company's attitude towards the energy transition, as expressed through its focus on natural gas and reducing its own carbon emissions, was a core element when considering the investment case. Natural gas is significantly less carbon-intensive than alternative fossil fuels like coal: the substitution of gas for coal in thermal electricity generation can make a substantial contribution to the reduction of carbon emissions globally. The high proportion of the company's production represented by natural gas is a theme featured repeatedly in the team's interactions with the company. In addition, the company has continued to show commitment to moving towards more sustainable forms of energy production by incrementally directing capital expenditure toward lower-carbon technologies such as floating wind, a stance supported by our investment team.

As part of its policy of considered, consistent engagement, the team met with senior management to discuss the Norwegian company's business mix as a competitive advantage. Our Head of ESG attended the inaugural SRI meeting with key management

figures, including the company's CEO, where the risks and opportunities posed by new technologies were discussed.

Case study 2:

Social - health & safety in focus

Our Henley-based Asian Equities team invested in an Indian private multi-port operator through a private placement. The team's analysis suggested that the company was trading at a significant discount to fair value estimates, due in part to ESG concerns. Throughout the ownership period, the investment team demonstrated commitment to challenging management on key issues, notably around the firm's health and safety record.

The team first encountered the company in early 2013 and, having researched the sector and company, took the view that this was a well-run business with unique assets. The investment appeared attractive and was trading at a significant discount to the team's estimate of fair value. According to their analysis, the shares had the potential to deliver a double-digit return per annum over a 3-5 year investment horizon. The team recognized, however, that the company suffered from challenges, in particular surrounding its social and governance behaviours.

Though a common feature of the industry and region, the potential re-rating identified was compromised by the firm's poor, and declining, record on a number of key issues. Notably, the company was the 'jewel' in a family-owned conglomerate and there were fears that cash flow could be diverted to less profitable areas of the group. The company had a poor health and safety record and the very nature of its operations, i.e. ports and infrastructure, threatened environment degradation and provoked local community discontent.

A key part of the team's investment strategy was to assess the materiality of the ESG risks, evaluate the soundness of the company's policies to minimize these risks and determine the extent to which the company was willing to engage in order to improve their practices. Over the investment period, the team continued to regularly engage with the company on ESG issues, believing that the long-term interests of investors would be best aligned with the company if it continued to pursue real improvements to its ESG agenda.

The company agreed to provide regular sustainability reports and updates on corporate social responsibility activities. Related-party transactions were also better understood following conversations with management and subsequent actions from the company were seen to be friendlier to minority shareholders. A change in management to the next generation of the family saw steps taken to significantly improve transparency and disclosures.

In 2017, a substantial incident occurred at one of the company's ports, which impacted revenue and caused social unrest. A proprietary ESG rating and report from our internal Head of ESG indicated that the company had room to improve its practices. Together with the Henley Investment Centre's Head of ESG, a meeting was arranged with management

to ascertain how the company was addressing the health and safety issues that had led to the incident.

Subsequent interaction showed an increased focus on health and safety. Management shared plans for significant training and education and the rolling out of ISO 14001, aimed at improving practices. In addition, the company put in place a much wider shareholder dialogue around these issues and substantially improved their corporate responsibility report, with year-on-year changes in not only health and safety but also environmental indicators. Over the investment period, the company demonstrated an improvement in key ESG indicators and the stock delivered an annualized return over the holding period, well in excess of the single-digit return of the wider Indian market.

Case study 3:

Governance - boardroom dispute resolution

A long-term investment of our Henley-based UK Equities team suffered a high-profile board level dispute in 2018, which caused notable share price pressure and instability at the company's highest level. As the majority shareholder, the team took steps to engage with the company to reduce the impact of the fallout and ensure appropriate governance remained in place.

In summer 2018, a high-profile board level dispute threatened the future of the UK logistics group. As the main and long-term shareholder, we became concerned with boardroom fallout which led to a proxy contest. A former executive director and minority shareholder of the company was disgruntled with the board chairman. This led to the former executive director declaring that he would vote against the chairman's re-election.

As a committed and concerned investor, we, on behalf of our clients, wrote to the company to state our intention to support the chairman's re-election. This decision was taken on the basis that the chairman was independent on appointment and had substantial board level experience. Removing the chairman would, the team felt, dilute the robustness and diversity of opinion on the board, which contained strong, varied expertise drawn from experience working with leading public and private companies. This view was echoed across the board and with senior management, which indicated they would resign if the chairman was removed. Recognizing that further instability would likely impact the group's planned growth strategy and its ability to optimize shareholder returns, the team decided to support the chairman.

Given the nature of the legal ramifications that unfolded, the impact of such evident discord on the company's share price was notable. Shares fell from both the uncertainty related to potential future management and board changes and negative sentiment fuelled by the high-profile nature of the fallout. In attempts to resolve the dispute and to minimize the impact on all shareholders, several investment team members engaged extensively with the chairman and the board to address the situation and prevent further share price deterioration. With the support of a majority of shareholders, the vote to re-elect the chairman was won and the long-term interests of all shareholders protected. Furthermore,

the team encouraged subsequent steps to strengthen the board and improve its diversity, which led to two new directors being appointed. The team also recommended that the chairman seek a successor by the end of 2019 to ensure no lasting impact on shareholders.

We believe that our role as active investors is fundamentally tied to active ownership.

Conclusion

Responsible investing can take many forms, and professional investors pursue a variety of approaches aimed at promoting positive ESG outcomes. As the ESG debate continues to evolve, so too no doubt, will investor approaches. As active investors, our view remains that the most effective way to achieve mutually beneficial outcomes for companies and investors is through active, investor-led engagement. We will continue to build out our tools, systems and approaches, guided by this overarching commitment to stewardship. In practice, engagement with investee companies has demonstrated positive outcomes for companies, our clients and other shareholders. We believe that our role as active investors is fundamentally tied to active ownership.

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Notes

- 1 Principles for Responsible Investment, A practical guide to active ownership in listed equity, February 2018.
- 2 Global Sustainable Investment Alliance, 2016 Global Sustainable Investment Review, 2017.
- 3 Principles for Responsible Investment, How ESG engagement creates value for investors and companies, April 2018.
- 4 Principles for Responsible Investment, How ESG engagement creates value for investors and companies, April 2018.

About risk

The value of investments and any income will fluctuate (this may partly be the result of exchange rate fluctuations) and investors may not get back the full amount invested.

Pension reform paves the way for target-date funds in Mainland China

By Nixon Mak

In brief

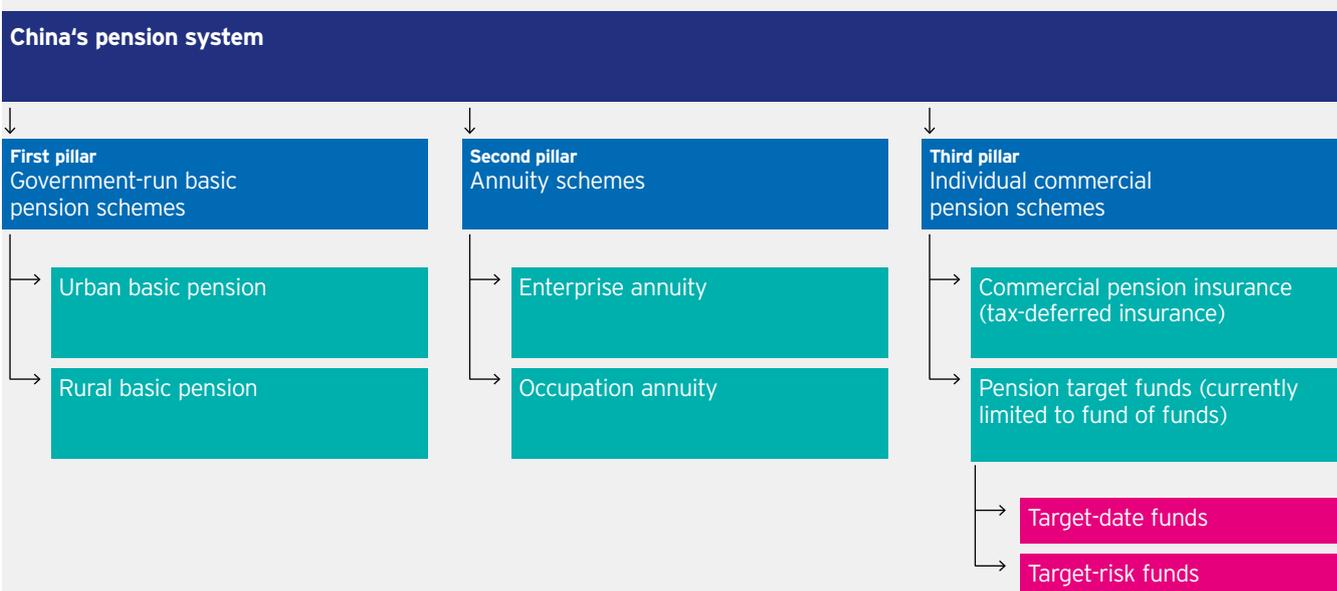
China wants to develop its private pension market. To this end, the government favours a system based on fund of funds (FoFs) or other vehicles that pursue only target-date, target-risk or other strategies approved by authorities. We expect that target-date funds in particular will become popular, with an expected market size of up to RMB 1.88 trillion (USD 280 billion). Socioeconomic trends will provide the impetus for rapid market growth over the next 10 to 20 years.

China has recently introduced guidelines on retail pension target funds, marking a key milestone in the development of the mainland's commercial pension system and asset management industry. Together with a team of students from the Cambridge Judge Business School's Master of Finance programme, Invesco studied the impact of these guidelines.

China's pension system rests on three pillars: a government-run basic pension scheme, an enterprise-run annuity scheme and individual commercial pension schemes (figure 1). Currently, this third pillar comprises retirement insurance plans and retirement investment products, or pension target funds. Chinese policymakers are attempting to reinforce the third pillar since the first two are facing increasing strain.

Chinese policymakers are attempting to reinforce the third pillar since the first two are facing increasing strain.

Figure 1
The three pillar structure



Source: Invesco, as at 3 January 2019.

Table 1
Recent developments in China's individual commercial pension segment

June 2017	March 2018	May 2018	August 2018
State Council provides guidelines for new commercial pension insurance products.	CSRC introduces guidelines on pension target funds.	Tax-deferred insurance pilot project launched in selected cities.	CSRC approves the launch of pension funds in the form of fund of funds.

Source: China Securities Regulatory Commission (CSRC), as at 30 October 2018.

One of the new guidelines for individual commercial pension schemes (table 1) is the China Securities Regulatory Commission's (CSRC) guidance on their structure: they should be constructed as FoFs and pursue target-date strategies, but also target-risk or other concepts approved by the CSRC.

The CSRC's preference for a FoF structure comes as no surprise since pension investments should place more emphasis on risk control than on the pursuit of returns. As a combination of funds, FoFs can offer investors a more diversified portfolio and reduce exposure to any single asset or risk.

In our view, the CSRC's approach is well-thought out, as it speeds up the development of the third pillar of China's pension system. By constructing FoFs, fund providers can use already existing products and combine them under a pension wrapper. This reduces the administration needed.

Estimating the size of China's target-date funds market

Among the different types of FoFs, we believe that target-date funds will become popular in China over time. They follow glide path structures that rebalance their allocations, so as the target date approaches, they focus less on growth and more on income. Even investors without in-depth financial knowledge

should find them easy to understand, which makes them attractive for retirement planning.

But how big can the market become? The mature US pension market, where target-date funds are very popular, may give an indication: over the past 10 years, US target-date mutual funds have received net inflows of USD 521 billion.¹ They ended 2017 with assets of USD 1.1 trillion, an increase of USD 229 billion, or 25.8%, from 2016.²

In estimating the potential size of China's target-date funds market, we referenced publicly available data to determine the number of people who would likely invest in such funds.³ For the lower bound estimate, we looked to the number of people under enterprise annuity schemes. Since the employer's contribution is forfeited if one leaves, we think these people (23.31 million of them) are most likely to invest in tax-deferred pension products.

For the upper bound estimate, we referenced another government report on the number of people contributing to the Housing Provident Fund.⁴ Monies contributed to the fund can be used to purchase housing or pay rent. The contributions are also matched by the employer and, since it counts towards income tax relief, people tend to contribute the maximum amount allowed. There are currently 130.6 million people contributing.

We believe that target-date funds will become popular in China over time.

As for calculating how much each individual is willing to contribute per month, another report noted that an individual is willing to contribute RMB 400 monthly into a pension plan if there are tax deferral benefits. Using RMB 400 as a base case scenario and RMB 1,200 as the upper bound, we calculated that the target-date funds market would reach a

Table 2
Estimating the potential market size of target-date funds in China (volume per annum, in RMB billion)

		Additional contribution in RMB per person per month				
		400	600	800	1,000	1,200
Participants (million)	23.31	112	168	224	280	336
	32.66	157	235	314	392	470
	65.32	314	470	627	784	941
	97.98	470	705	941	1,176	1,411
	130.64	627	941	1,254	1,568	1,881

Source: Calculated by Invesco, as at 3 January 2019.

volume of at least RMB 112 billion, and could become as large as RMB 1.88 trillion (USD 280 billion, table 2).

What may prevent the market from achieving full potential?

The market still needs to overcome some limitations before it can achieve its full potential of RMB 1.88 trillion.

Currently, for instance, there are restrictions on who can qualify as a fund provider, the underlying fund sizes, the use of derivatives and access to foreign markets. These factors limit the number of fund houses that can offer such products.

At the same time, target-date funds still do not enjoy tax incentives. China recently rolled out a one-year tax deferral pilot scheme for pension insurance products. Given that the pilot was only introduced in selected cities, we would need to wait for detailed findings to determine whether the tax deferral scheme was helpful in promoting pension insurance products to the public. The pilot is set to end in May 2019.

Should the pilot for pension insurance products turn out to be a success, there is a chance that authorities would extend tax deferral benefits to pension target funds. Having similar tax deferral benefits will no doubt aid in the target-date funds market's long-term development. Officials have also talked about applying a default investment mechanism, much like how the US enables automatic enrollment into target-date funds for employer-sponsored retirement savings 401(k) plans. We look forward to more policy developments in China on tax incentives for pension target funds.

Aside from policy hurdles, there are also some market dynamics that weigh on the market's growth potential (table 3). For example, awareness is still lacking when it comes to retirement planning in China. A survey conducted in 2017 showed that only 9% of 2,013 respondents across several Chinese cities say that they are "very involved" in monitoring and managing their retirement savings.⁵ At the same time, banks are the primary channels for fund distribution in China, and they may prefer distributing mutual funds over FoFs due to mutual funds' relatively simpler structures. In addition, FoFs' key selling point

Table 3
Limitations on China's target funds market development

Issue		US	China	Analysis
Developing asset management industry	Underlying fund size	No limit	Average net asset value of at least RMB 200 million in the past two years	Short-term bottleneck, but expected to improve
	Use of derivatives	Allowed	Not allowed	Derivatives market in China likely to develop, hence may not be a critical issue considering long lifespan of target-date funds
	Access to foreign markets	Allowed	Theoretically possible via products for Qualified Domestic Institutional Investors (QDII), where approved domestic institutional investors can invest in foreign products	Difficult to achieve in China at present stage
Policy support	Policy support	Default investment option for 401(k)	None	Chinese individuals would have to purchase target-date fund on their own initiative
	Tax incentives	Tax deferred	None	Beijing introduced tax deferral policy for insurance schemes likely to be extended to target-date funds to ensure fairness and competitiveness
Distribution	Distribution	Varied	Through banks, security companies, third-party independent channels	<ul style="list-style-type: none"> - Current market structure favours large institutions who dominate fund sales channels - Fintech platforms offer a chance to open new banking and sales opportunities

Source: Invesco, as at 3 January 2019.

of broad diversification and lower risk may also work against them - as they can find it difficult to outperform specific markets or funds with a narrower focus.

Nevertheless, we are confident that proper, sustained and widespread dissemination of retirement planning information will help to resolve these issues so that the target-date funds market can organically develop.

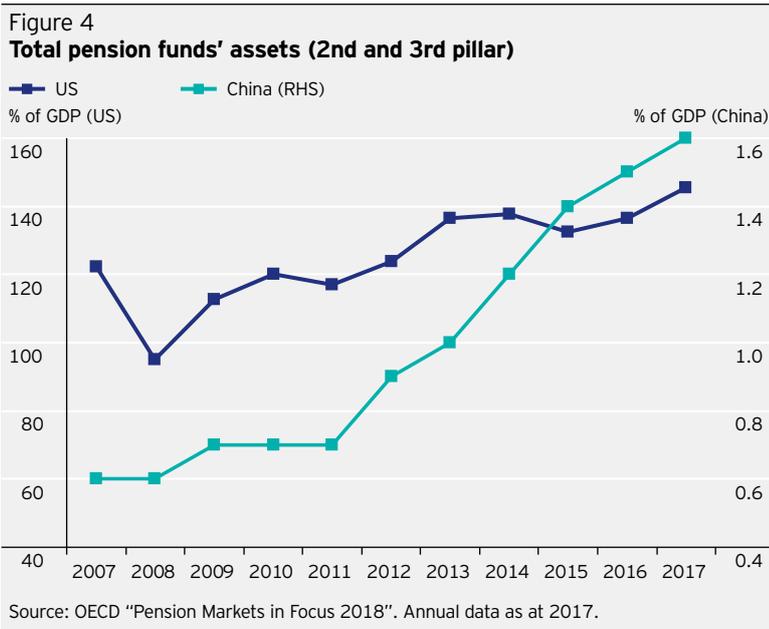
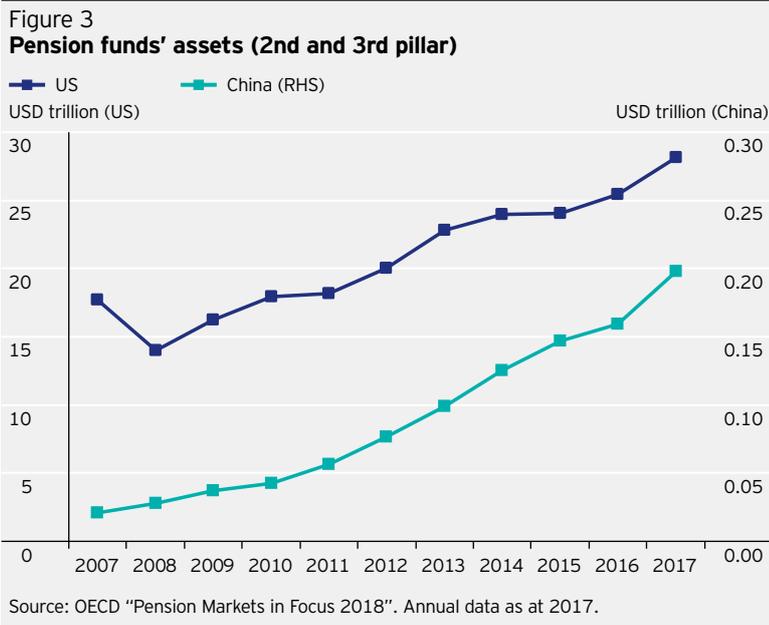
Broader trends will drive growth

Our expectation that China's pension target fund market will grow is also supported by some broader trends. In fact, we think it may even grow beyond the upper bound of our initial analysis. Once again taking the US as a proxy, we expect China's target-date funds market to see the same pace of development and grow rapidly over the next 10 to 20 years.

Our expectation that China's pension target fund market will grow is also supported by some broader trends.

A major driver of this expansion will be growing affluence in China, where disposable income per capita is rising faster than GDP, registering a compounded annual growth rate of 7.24% from 2013 to 2017.⁶ As Chinese households grow richer, they are likely to shift from savings to investments as a means to preserve or increase wealth. In 2017, US private-pension plans held assets totaling some USD 28.17 trillion, representing 145.3% of the country's GDP (figures 3 and 4). For China, private-pension plans only hold USD 197.8 billion in assets - or 1.6% of GDP.⁷ Thus, there is plenty of room for the target-date funds market to grow.

Demographic trends will also fuel this expansion. At the end of 2017, China's elderly dependency ratio was at 15.9%, almost a full percentage point higher than 2016's ratio of 15%.⁸ China's retirement needs will therefore intensify, and the pension system must be able to cope with them.



Parallel to these trends is the growth of China's capital markets. We note Beijing's recent efforts aimed at improving its capital markets and asset management sector. At the same time, asset managers' keen interest in providing FoFs underscores their confidence in the growth of China's individual commercial pension market. We believe that, in due time, there will be more and more financial products that will help in the further development of China's target-date funds market.

We expect to see the emergence of new investment opportunities.

Conclusion

Recent guidelines issued by Chinese authorities in March 2018 have opened the market for pension funds in the form of FoFs. We believe that target-date funds will prove to be among the more popular products and foresee socioeconomic trends giving the market a further boost. Continued policy reforms are likely to help the market grow rapidly over the next one or two decades. As such, we expect to see the emergence of new investment opportunities.

About the author



Nixon Mak

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Nixon Mak joined Invesco in 2016 and serves as Head of Hong Kong Pensions & Solutions Strategist, Asia Pacific. He has 20 years of experience and is now responsible for asset allocation of Invesco's Hong Kong pension and Mandatory Provident Fund (MPF) mixed-asset strategies, as well as identifying opportunities for developing new multi-asset products and solutions for clients in the Asia Pacific region.

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- 1 2018 Investment Company Fact Book, Investment Company Institute.
- 2 Ibid.
- 3 Annual Report on the State of Human Resource and Social Security Development in China 2017, Ministry of Human Resources and Social Security, People's Republic of China (PRC).
- 4 National Housing Provident Fund Report 2016, Ministry of Finance, PRC.
- 5 The Future of Retirement in China, Society of Actuaries (US), 2017.
- 6 National Bureau of Statistics of China.
- 7 Pension Markets in Focus 2018, The Organisation for Economic Co-operation and Development (OECD).
- 8 National Bureau of Statistics of China, retrieved on 17 October 2018. Elderly dependency ratio is defined as the number of elderly dependents aged 65 and above divided by the number of working-age persons from 15 to 64 years old.

Low volatility anchoring

By Michael Milano and Sergey Protchenko

In brief

We review the development of the exposures in three portfolios (minimum variance, market and low volatility) anchored by the first two variants (min var and market) to quality, momentum and value. Furthermore, we show that a low volatility portfolio can lead to stable factor exposures over time, something which cannot be definite for the two anchor portfolios. With the described approach, the low volatility anomaly can be exploited whilst also being exposed to quality, momentum and value - not a given with concepts based purely on the minimum variance or the market portfolios.

With mounting evidence in support of the “low volatility anomaly” - i.e. the tendency of comparatively stable stocks to achieve abnormal returns - more and more investment products have been developed with the aim of exploiting it. These products span a diverse set of styles, from traditional active management to passive indexing.

One of the earliest textbook approaches to harnessing the low volatility anomaly is a minimum variance strategy.

One of the earliest textbook approaches to harnessing the low volatility anomaly is a minimum variance strategy aimed at minimizing the total risk of a diversified portfolio of risky assets. Indices were developed with exactly this goal. For the MSCI Minimum Volatility indices, a parent MSCI index is optimized with an estimated security co-variance matrix in order to produce the index with the lowest possible absolute volatility for a selected set of constraints. The benefits of this approach are its simplicity and relatively low execution costs. Obviously, there is no need for individual stock or portfolio return forecasts since the goal is minimizing volatility rather than maximizing returns. While this concept's transparency is appealing, the resulting portfolio structure depends heavily on past correlations between the available investment options, with a particularly heavy weight on the most recent co-movements.¹ If individual stock volatilities and their co-movements resemble those of the recent past, this should lead to a high effectiveness in execution. However, this may not be the case if the market environment changes.

Other approaches typically either use a low volatility factor or a portfolio construction process designed to balance the risk/return benefits of low volatility investing with longer-term return expectations and return drivers. For us, the minimum variance portfolio (MinVar) and the cap weighted market portfolio (for example the S&P 500 in the US) are natural anchors for the portfolio construction process. By targeting a risk level below that of the market portfolio but above the minimum variance portfolio, we capture the risk/return benefits of the low volatility anomaly as well as long-term multi-factor exposures.



It is important to understand that the drivers underlying the two anchors of our risk target are not static through time. What do we mean by this? We all know that sometimes the market is “cheap”, whereas at other times it is “expensive”. Seen through the factor lens, “cheap” means “high exposure to the value factor” and vice versa. Other factors we track are quality, earnings momentum and price momentum. Below, we analyse the factor exposures of the minimum variance portfolio, the market portfolio and a low volatility portfolio.

Factor exposures of the minimum variance portfolio

For a minimum variance portfolio, negative exposure to volatility is a given. But, what other characteristics come to mind? For instance, we would expect the portfolio to have positive exposure to quality and value. Figure 1 shows the average factor exposures of a US minimum variance portfolio from January 1994 to May 2018.

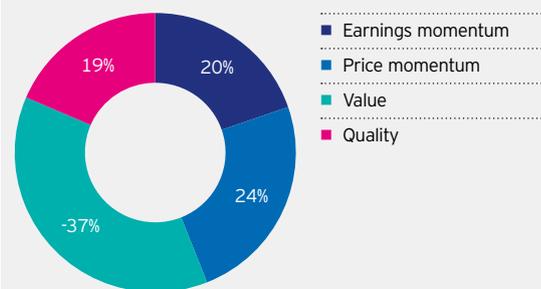
Obviously, the quality factor dominates with value coming in second. On average, there is no exposure to the earnings momentum; in fact, exposure to earnings momentum is negative. These average results make perfect sense, but factor exposures are not static. For example, as figure 2 shows, they were quite different in May 2018, when the momentum factors dominated, with both price and earnings

Figure 1
Average factor exposures of a US minimum variance portfolio



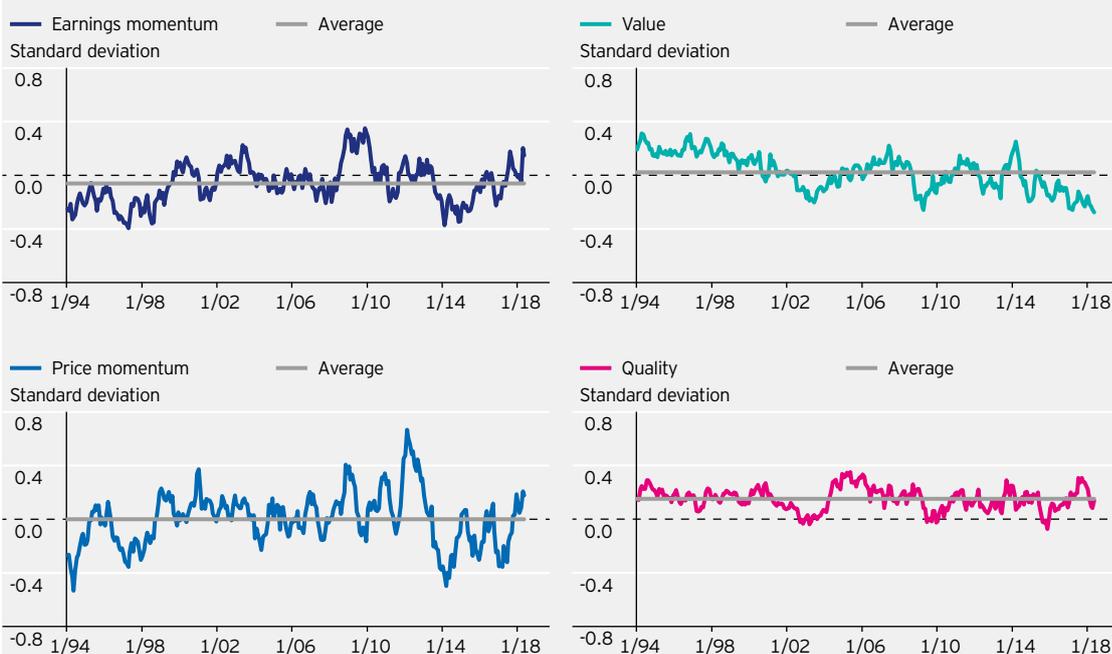
Based on monthly data for the MSCI USA Minimum Volatility (USD) index from January 1994 to May 2018. Source: MSCI, Invesco calculations. All information presented prior to the inception date of June 2008 is back-tested. Back-tested performance is not actual performance, but is hypothetical. Although back-tested data may be prepared with the benefit of hindsight, these calculations are based on the same methodology that was in effect when the index was officially launched. **Performance, actual or hypothetical, is not a guide to future results.** An investment cannot be made in an index.

Figure 2
Factor exposures of a US minimum variance portfolio in May 2018



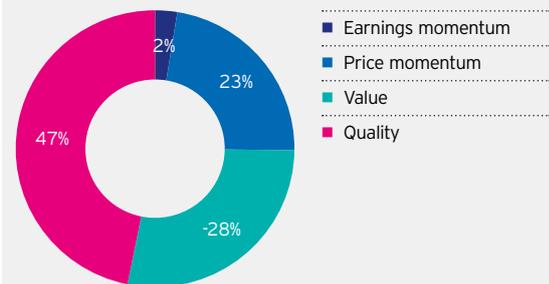
Based on monthly data for the MSCI USA Minimum Volatility (USD) index for May 2018. Source: MSCI, Invesco calculations.

Figure 3
Development of the factor exposures of a US minimum variance portfolio



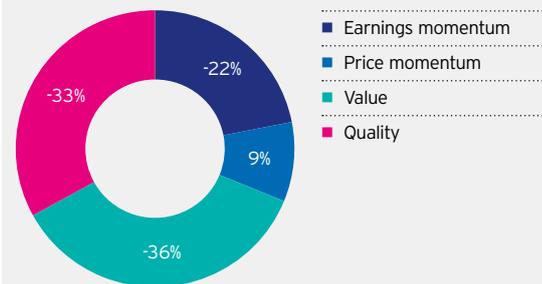
Based on monthly data for the MSCI USA Minimum Volatility (USD) index from January 1994 to May 2018. Source: MSCI, Invesco calculations.

Figure 4
Average factor exposures of a European minimum variance portfolio



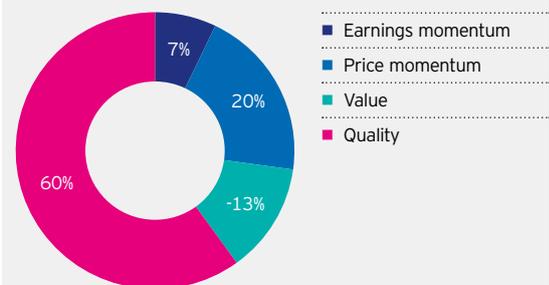
Based on monthly data for the MSCI Europe Index from January 1994 to May 2018.
Source: MSCI, Invesco calculations.

Figure 6
Factor exposures of a European minimum variance portfolio in May 2018



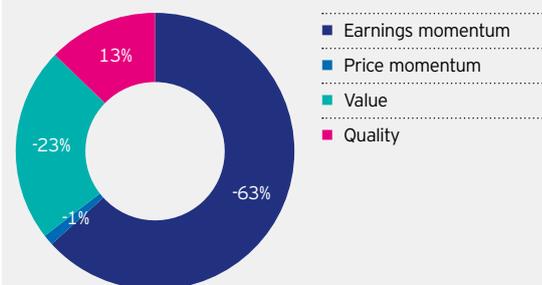
Based on monthly data for the MSCI Europe Index for May 2018.
Source: MSCI, Invesco calculations.

Figure 5
Average factor exposures of a global minimum variance portfolio



Based on monthly data for the MSCI World index from January 1994 to May 2018.
Source: MSCI, Invesco calculations.

Figure 7
Factor exposures of a global minimum variance portfolio in May 2018



Based on monthly data for the MSCI World index for May 2018.
Source: MSCI, Invesco calculations.

momentum having higher exposure than quality, along with a negative exposure to value.

While the May 2018 exposures appear significantly outside of the norm for minimum variance portfolios, they make perfect sense. At that time, the US market was dominated by five expensive companies with strong earnings and price momentum. Due to their low volatility, they suddenly formed the core of the minimum variance portfolio.

A rising exposure to momentum factors is not uncommon. As shown in figure 3, periods with above-average exposure to these factors occur frequently. For example, exposure to earnings momentum increased significantly in November 2008 - and since its all-time low in February 2014, this factor exposure has been on a steady climb. At the same time, value exposure dropped to an all-time low in May 2018.

If the low volatility approach is simply a replication of the MSCI USA Minimum Volatility (USD) index or an actively managed portfolio with this benchmark, exposure to the low volatility anomaly comes with additional exposures that are not always intuitive, and not always desirable. In May 2018, someone who had invested in a simple minimum variance portfolio would have been sitting on an expensive, momentum-loaded portfolio with exposures significantly different from those in the past.

If the low volatility approach is simply a replication of the MSCI USA Minimum Volatility (USD) index, exposure to the low volatility anomaly comes with additional exposures that are not always intuitive, and not always desirable.

EU and global minimum variance portfolios

Comparing minimum variance portfolios constructed over the MSCI Europe or MSCI World, we can see that there are some consistency differences among the portfolios. While the US, EU and global portfolios all have significant positive exposure to quality (figure 1, 4, 5), momentum and value exposures are very different. The US MinVar portfolio tends to have a positive exposure to value and negative exposure to momentum while the EU and global portfolios experience the opposite.

As with the US portfolio in May 2018, the EU (EU MinVar) and global minimum variance (Global MinVar) portfolios also appear to be outside the norm per figure 2, 6, 7. The EU MinVar portfolio maintains

Figure 8
Average factor exposures of a US market portfolio

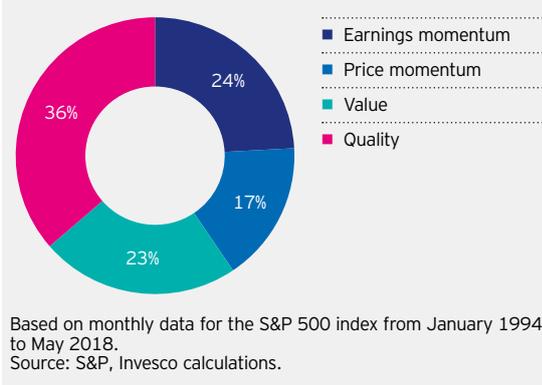


Figure 9
Factor exposures of a US market portfolio in May 2018

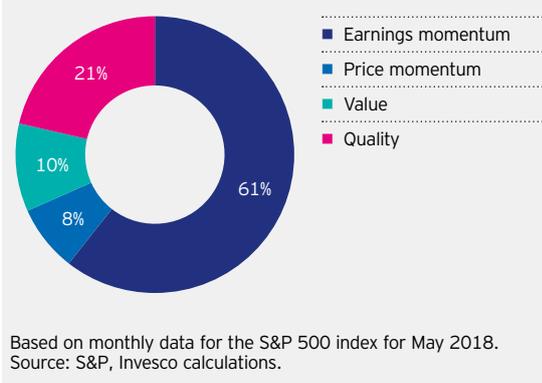
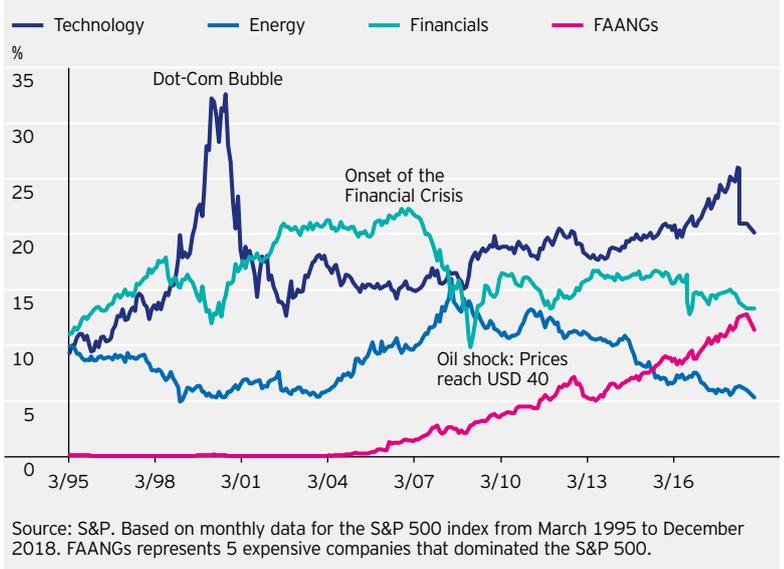


Figure 10
Development of S&P sector weights



positive exposure to price momentum while all other exposures become negative. Conversely, the global MinVar portfolio maintains positive exposure to quality while all other exposures become negative.

Factor exposures of the market portfolio

As the other component of the volatility anchor, the cap-weighted market portfolio, in this case S&P 500, goes through similar exposure fluctuations as the minimum variance portfolio. On average, the S&P 500 portfolio has positive exposures to all four factors, with quality slightly dominating the others (figure 8).

Figure 11
Development of the factor exposures of a US market portfolio

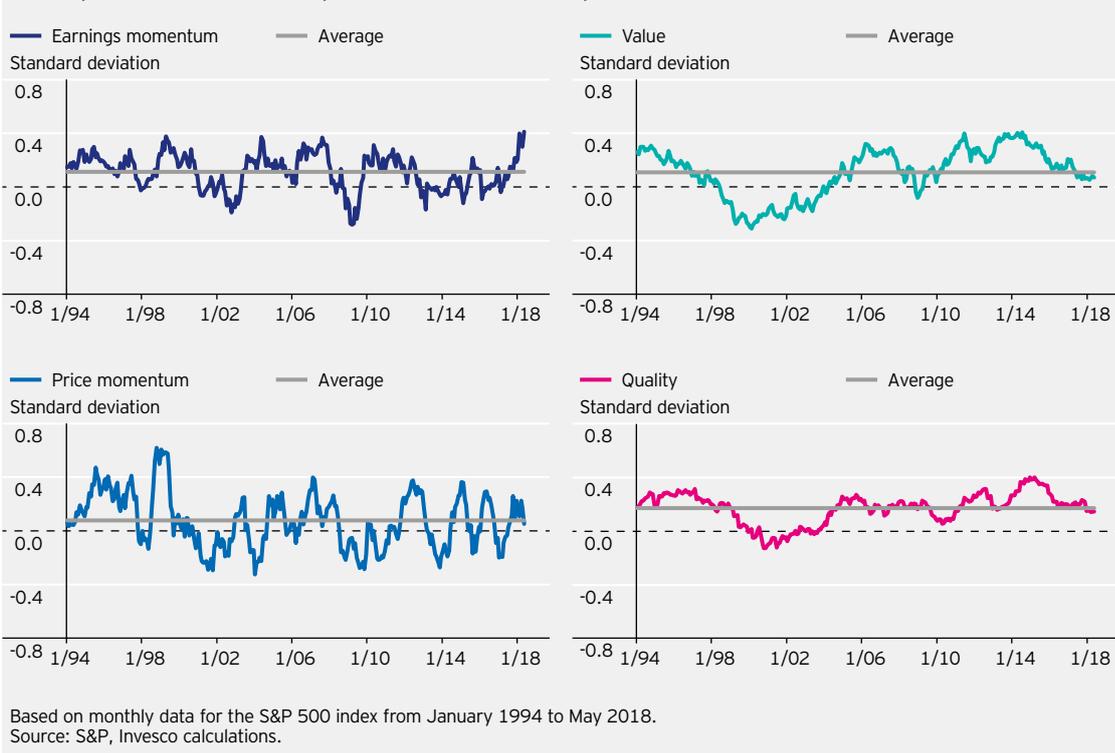
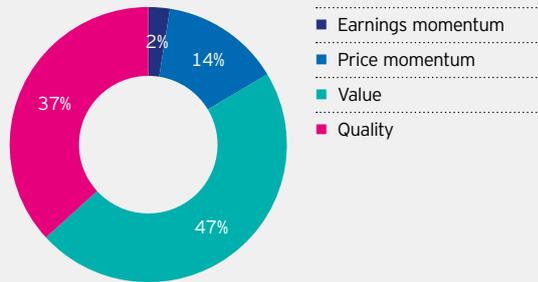
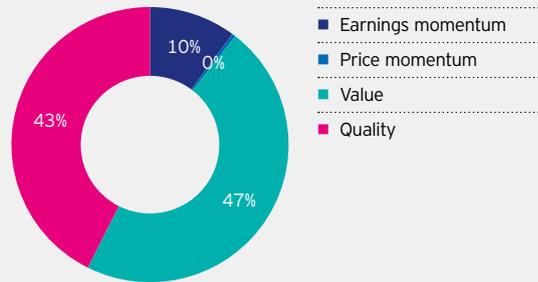


Figure 12
Average factor exposures of a European market portfolio



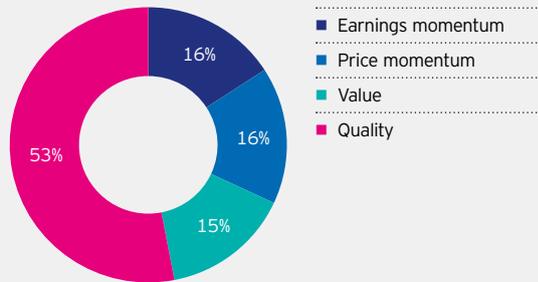
Based on monthly data for the MSCI EU Index from January 1994 to May 2018.
Source: MSCI, Invesco calculations.

Figure 14
Factor exposures of a European market portfolio in May 2018



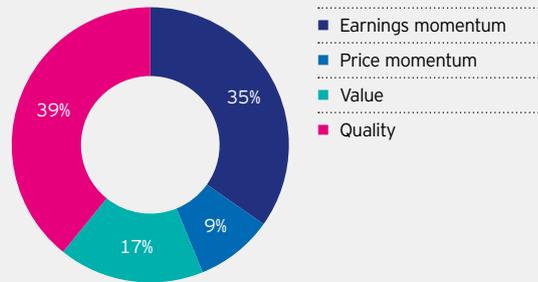
Based on monthly data for the MSCI EU Index as at May 2018.
Source: MSCI, Invesco calculations.

Figure 13
Average factor exposures of a global market portfolio



Based on monthly data for the MSCI World Cap Index from January 1994 to May 2018.
Source: MSCI, Invesco calculations.

Figure 15
Factor exposures of a global market portfolio in May 2018



Based on monthly data for the MSCI World Cap Index as at May 2018.
Source: MSCI, Invesco calculations.

Once again, May 2018 stands out: in this month, the portfolio was dominated by the earnings momentum factor, comprising 61% of total factor exposure (figure 9).

Here as well, a few expensive companies were the driving force behind the dominance of momentum factors (figure 10). Furthermore, figure 11 shows that rising earnings momentum exposure - essentially to a 10-year high - coincided with a decreasing exposure to value - to a 10-year low.

EU and global cap weighted portfolios

Anchoring counterparts to EU MinVar and Global MinVar are the MSCI EU and MSCI World Cap Weighted Indexes. From figure 8, 12 and 13, you can see that all three markets, on average, have positive exposures to the alpha factors. As the charts show, these three markets are not all the same - the combination of value and quality seems to dominate the EU market while quality represents more than half of the global market exposure.

May 2018 data show that the EU market exposures are not that different from the long-term average while the global market exposures have shifted closer to the US market exposures for the same time period (figure 9, 14, 15). Though not as extreme as the US, the global market exposures saw a very large increase in earnings momentum exposure; this makes perfect sense given the proportional weight of the US in the global index.

Factor exposures in a low volatility portfolio

We stand firmly behind a multi-factor approach to investing. The low volatility anomaly is captured through the portfolio construction process, using the minimum variance and the market portfolios as anchors for the volatility target while maintaining consistent exposure to four key factors. Figure 16 shows that, on average, a balanced exposure to all factors is maintained across the low volatility portfolios, and this did not deviate much in May 2018, as seen in figure 17.

The US low volatility portfolio maintained positive and significant exposure to all four factors.

The US low volatility portfolio maintained positive and significant exposure to all four factors throughout the observation period (figure 18). Unlike the minimum variance portfolio, which at times became negatively exposed to value, or the S&P 500 (which was dominated by earnings momentum), the low volatility portfolio maintained balance in all exposures.

Why does the low volatility anomaly exist? Five reasons

According to standard capital market theory, volatile stocks should perform better than stable ones since higher returns are seen as a reward for higher risks (e.g. more volatility). However, empirical findings often suggest the opposite, with low volatility stocks beating the market. Here are a few reasons which may explain the so-called "low volatility anomaly". The first three reasons are based on cognitive biases, the remaining on market microstructure.

Loss aversion: First described by Daniel Kahneman and Amos Tversky in 1984, loss aversion reflects people's tendency to prefer avoiding losses (or negative experiences) over acquiring equivalent gains (or positive experiences). When individuals in an experimental setting were presented with a scenario where a considerable gain and a considerable loss were equally likely, the preference for avoiding the loss was between 1.5-2.5 times higher than the preference to acquire the equivalent gain. Interestingly, when individuals were presented with a highly improbable (but extremely high) gain combined with a very likely but limited loss, there was a strong tendency to attach a higher weight to the unlikely, but high, payoff. Informally referred to as the lottery effect, this finding not only explains the popularity of lotteries, but also the tendency for investors to consistently pay too much for a limited number of highly volatile stocks with the possibility - though minute probability - of an extremely high payoff.

Overconfidence: Daniel Kahneman also showed that individuals relying on heuristics (experiments, trial & error, rules of thumb) systematically overstate the subjective probability of their own success. This commonly results in setting far-too-narrow confidence intervals for potential outcomes. Overconfidence would be consistent with an excessive demand for highly volatile stocks as investors would systematically overestimate their predictive power. Consequently, such stocks would be overvalued, leading to lower returns when compared to stocks with a lower volatility.

Representativeness: Another behavioural bias noted by Kahneman and Tversky in 1974 is the tendency to overestimate the probability of a specific event if it shares characteristics with a prototypical category event. Loosely interpreted, there is a tendency to overestimate the likelihood of an occurrence that appears consistent with the individual's prejudices. This would contribute to the overvaluation of highly volatile stocks if they are perceived to share a characteristic with another volatile, but highly performing stock.

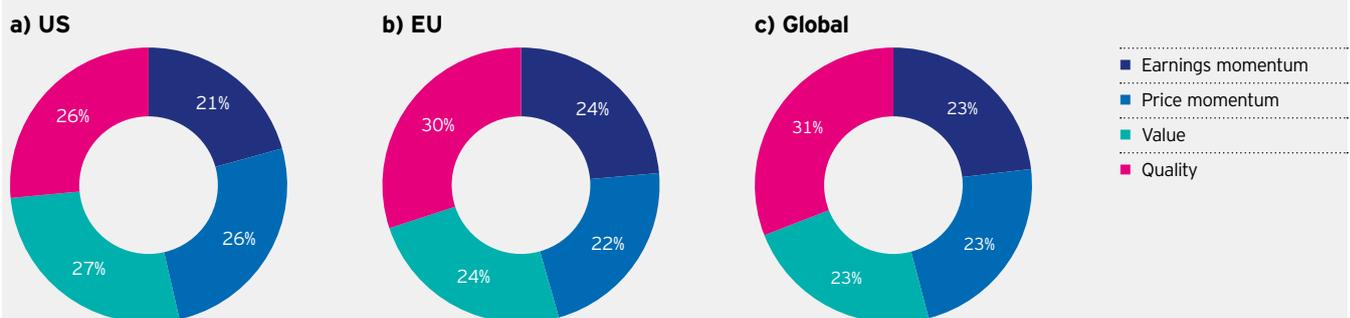
Convincing as these arguments may be, they do not fully explain why the low volatility anomaly, once known, does not disappear as arbitrageurs act to exploit it. This is where market structure comes into play:

Leverage restrictions and leverage aversion: First highlighted in 1972 by Black, Scholes and Jensen, and more recently discussed in 1992 by Fischer Black and Robert Litterman, leverage restrictions prevent many large-scale market participants from shorting securities or engaging in any form of leverage. Corporate entities as well as many retail and institutional fund managers are prevented from even minimally employing leverage to increase their funds' expected returns. Instead, they are forced to concentrate on more volatile stocks at times when they are more comfortable taking risks. Again, this may lead to an overvaluation of highly volatile stocks, thus limiting their return prospects.

Benchmarking: Manager skill is typically assessed on the basis of excess return and tracking error relative to a fixed, cap weighted benchmark. A low-beta stock would on balance need a correspondingly higher expected excess return in order to offset the increased tracking error, creating an incentive to invest in higher beta (i.e. more volatile stocks). Again, more volatile stocks would tend to be overvalued, leaving them with lower return potential. This was first suggested in 1993 by M.J. Brennan and again by Baker, Bradley and Wurgler in 2010.

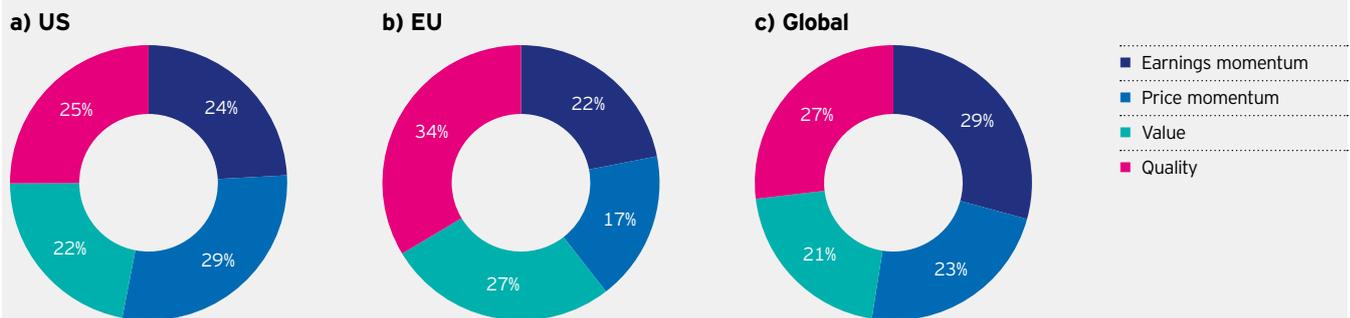
Figure 16

Average factor exposures in low volatility portfolios



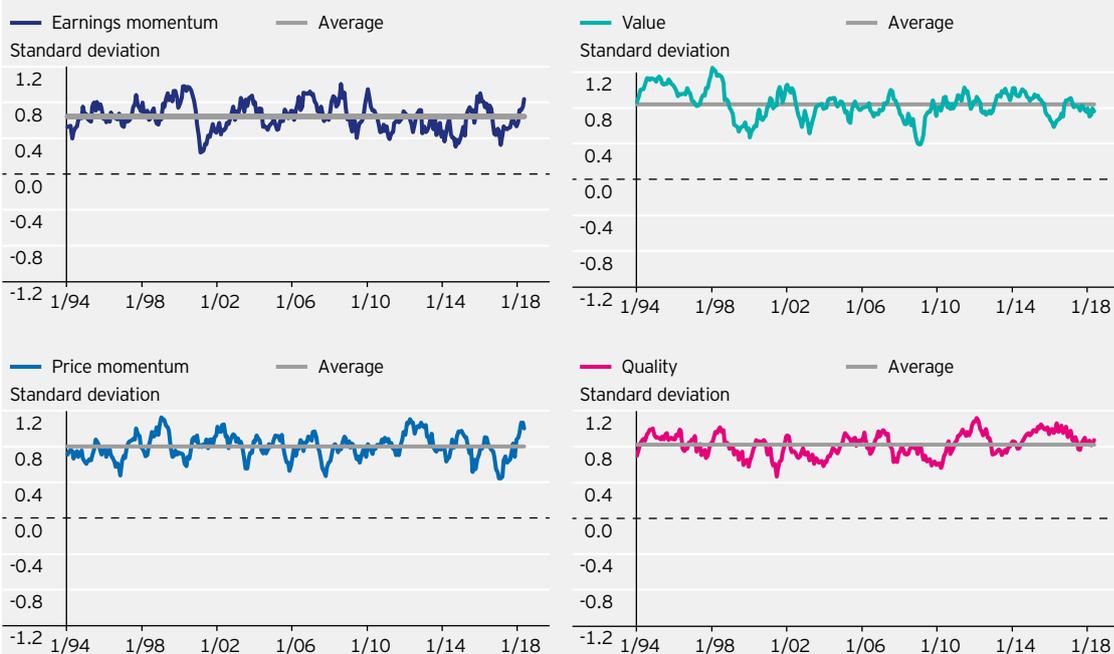
Based on monthly data for the low volatility portfolios from January 1994 to May 2018. Source: Invesco.

Figure 17
Factor exposures of the low volatility portfolios in May 2018



Based on monthly data for the low volatility portfolios in May 2018.
 Source: Invesco.

Figure 18
Development of the factor exposures of the US low volatility portfolio



Based on monthly data for the low volatility portfolio from January 1994 to May 2018.
 Source: Invesco.

The low volatility approach delivered a less volatile portfolio than the market portfolio and results that were not overly concentrated in one theme.

The low volatility approach delivered a less volatile portfolio than the market portfolio and results that were not overly concentrated in one theme.

Table 1 shows that, in May 2018, the minimum variance portfolio was concentrated in Utilities and Consumer Discretionary, representing 40% of the portfolio. The market portfolio had a very high exposure in IT stocks, which represented almost 30% of the portfolio. Due to our approach, the low volatility portfolio had fairly balanced exposures to Utilities, Materials, IT, Industrials and Financials in order to capture the low volatility anomaly and maintain the desired exposures.

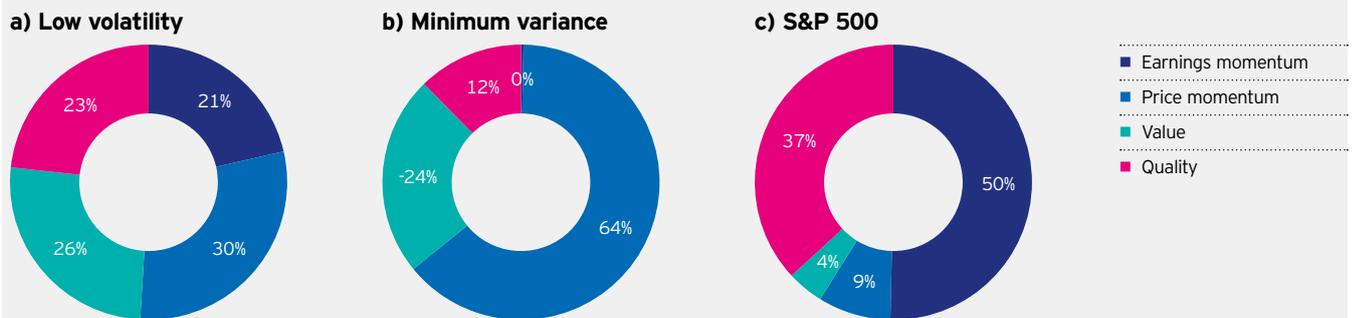
Viewing these portfolios through December 2018, figure 19 shows that even with the significant fourth-quarter market drops, the low volatility portfolio continued to maintain balanced exposures. The S&P 500 gave up some of its massive earnings momentum skew in favour of quality while minimum variance was completely dominated by price momentum.

Table 1
Net US portfolio weights in May 2018

Sectors	Minimum variance portfolio	S&P 500 portfolio	Low volatility portfolio
Utilities	23.7%	2.9%	14.6%
Telecommunications	1.2%	1.9%	8.6%
Materials	5.7%	2.9%	10.2%
Information Technology	6.9%	28.7%	13.2%
Industrials	4.2%	9.9%	20.5%
Health Care	7.3%	13.8%	6.9%
Financials	13.0%	17.4%	10.0%
Energy	5.7%	6.2%	7.5%
Consumer Staples	12.6%	7.3%	1.3%
Consumer Discretionary	19.8%	9.0%	7.2%

Source: MSCI, S&P, Invesco.

Figure 19
Exposures in US portfolios, year end 2018



Based on monthly data for the portfolios as at December 2018.
 Source: Invesco.

When evaluating a low volatility approach, it is important to understand what is being used to anchor the portfolio.

Conclusion

When evaluating a low volatility approach, it is important to understand what is being used to anchor the portfolio. Constructing a portfolio with a “minimum variance” or one with a slightly higher

volatility than the minimum variance will capture the low volatility anomaly but at the same time expose the investor to other potentially unwanted characteristics, such as negative exposure to value in momentum-driven periods. On the other hand, a portfolio anchored to a cap weighted market index simply trying to deliver a volatility below that of the market (but with similar exposures) may easily lead to a highly concentrated portfolio, as it did in May 2018 when earnings momentum dominated. Investors should be aware of the different approaches since it has a direct impact on the overall performance of the portfolio.

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Note

1 MSCI Minimum Variance Index Construction; Barra Global Equity Model Handbook.

About risk

The value of investments and any income will fluctuate (this may partly be the result of exchange rate fluctuations) and investors may not get back the full amount invested. All investing involves risk.

Equal weighting in sector portfolios

By Brad Smith

In brief

In this study of the effects of equal weighting within equity sector portfolios, we find that the diversification benefits of equal weighting are more pronounced compared to broader-based portfolios. This is supported by numerous descriptive statistics for cap weighted and equally weighted S&P 500 sector portfolios over the past ten years.

The evidence presented below shows that equal weight strategies have outperformed similar market cap weighted (MCW) strategies over the past 10 years. The objective of this article is to provide a deeper understanding of why these strategies behave the way they do, thus making them more transparent and easier to evaluate. To begin, investors should understand that these strategies are one form of factor investing, which is differentiated from other investment options in specific ways.¹ In short, equal weight strategies indirectly result in a portfolio systematically exposed to the small cap factor, which we believe explains much of the results. The strategy also produces a slight tilt towards the value factor. We then delve deeper into this approach and its application to sector portfolios. When controlling sector allocations is a part of an overall investment strategy, we believe equal weight portfolios offer a compelling option, particularly in comparison to market weighted sector strategies.

First, we look at a broad market equal weighted strategy. Equal weighting (EW) a portfolio provides two primary benefits relative to market capitalization:

- 1) Reduced concentration, which can potentially lead to enhanced diversification
- 2) Beneficial factor tilts

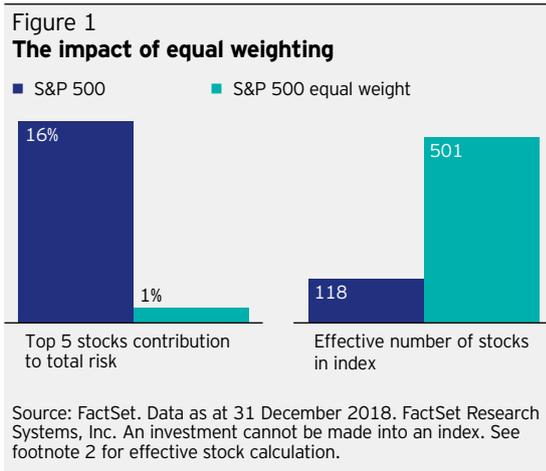
These benefits have been well documented for broad based equity portfolios with some key summary statistics provided in this article. Typically these benefits come with some additional risks such as higher volatility and larger drawdowns. Further, in momentum driven markets, equal weighting tends to be a drag on performance since the portfolio systematically rebalances away from higher momentum companies that have had strong recent performance. The purpose of this paper is to study the effects of equal weighting within more narrow portfolios, such as sector-specific portfolios. We find that within more narrow portfolios the diversification benefits of equal weighting become more pronounced due to less idiosyncratic risk.

The purpose of this paper is to study the effects of equal weighting within more narrow portfolios, such as sector-specific portfolios.



Enhanced diversification potential

Market cap weighting leads to the largest securities driving a significant portion of the portfolio performance. In the case of the S&P 500 Index for instance, the ten largest companies contribute 25% of the portfolio's price volatility. This high idiosyncratic risk can be mitigated by equally weighting the portfolio. Equally weighting the portfolio greatly reduces the risk from the top holdings and spreads the risk across the portfolio. This shift leads to a much higher effective number of stocks in the portfolio (figure 1) using the Herfindahl index approach.²



Beneficial factor tilts

Equally weighting stocks compared to market cap weighting results in more meaningful exposure to smaller market cap stocks. This exposure is associated with a well-documented potential source of excess returns, or factor premium. Due to these rewarded factor tilts, the equal weight S&P 500 has outperformed the market cap S&P 500 over every 10-year period since April 2003. During rebalances, an equal weight strategy will sell stocks that have appreciated and buy those that have fallen in weight. This generally results in the strategy having tilts in favor of small size and higher volatility, with a negative momentum factor tilt (figure 2).

These tilts resulted in equal weight having a higher volatility and beta, which has historically led to its

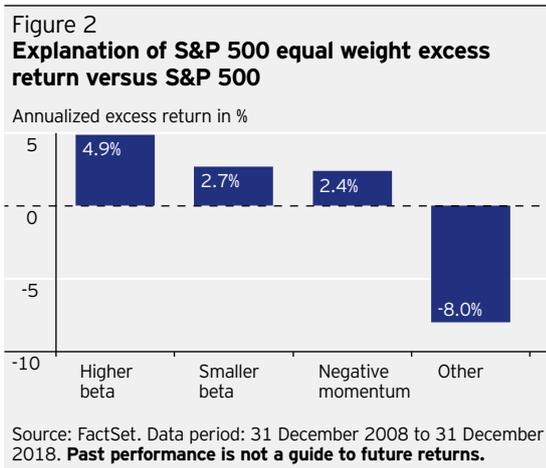
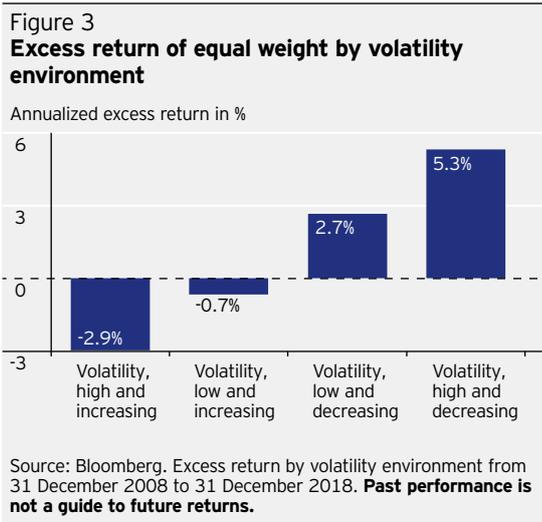


Table 1
10-year modern portfolio theory statistics

	Beta	Volatility	Annualized return
S&P 500 Equal Weight Index	1.11	15.6%	15.0%
S&P 500 Index	1.00	13.6%	13.1%

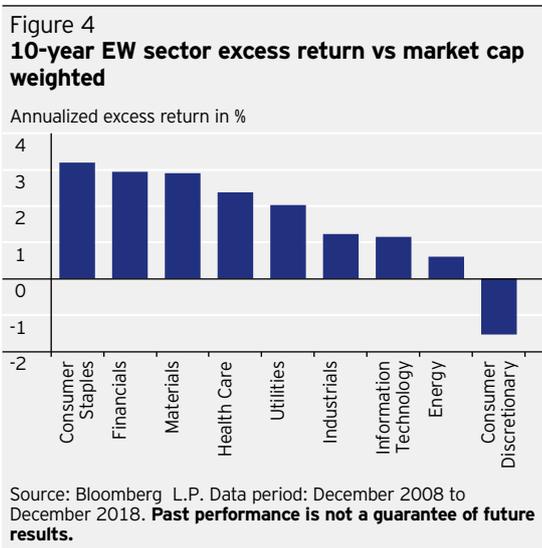
Source: Bloomberg. Data period: 31 December 2008 to 31 December 2018.



outperformance in environments when volatility was high but is decreasing (table 1 and figure 3).

Equal weighting sectors

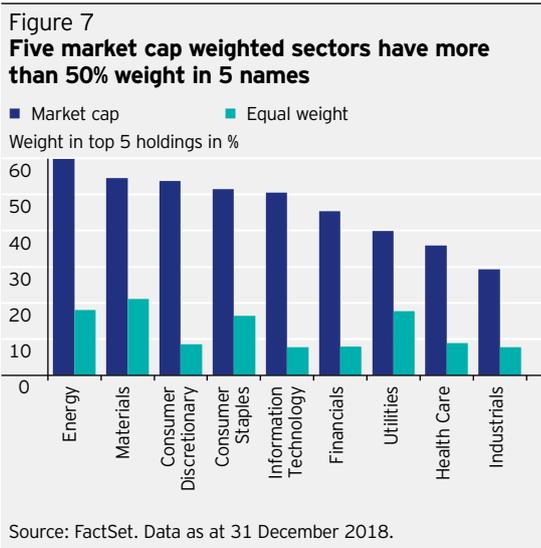
Equal weighting within sectors provides similar effects on sector portfolios. However, some of the potential benefits are enhanced and certain drawbacks diminished. Similar to equal weighting on the S&P 500, equal weighting within sectors results in long-term excess return as well as higher risk-adjusted returns (figure 4 and 5). Over the past 10 years, all the equally weighted sectors, except



Consumer Discretionary, outperformed their market cap weighted sectors. Underperformance in consumer discretionary was driven by equal weight's 8% underweight position in one Consumer Discretionary company. Over that period, this company returned 40% annually. The Real Estate and Communication Services sectors were excluded from our analysis due to their limited history.

Over the past 10 years, six of the nine equal weighted sectors studied delivered higher Sharpe ratios than market cap weighting (figure 5).

While many of the key benefits of equal weighting remain when applied to sectors, certain drawbacks are mitigated. Surprisingly, the higher beta and volatility behavior seen in the equal weight S&P 500 do not hold when equal weighting is used on sectors. When the broad US market portfolio is market cap weighted, mega-cap names partially reduce the idiosyncratic risk of the top holdings, but when split into sectors, these mega-cap names tend to dominate each sector. Thus, the idiosyncratic risk in the sector portfolio rises. On average, over half of each market cap weighted sector's risk is concentrated in five companies. Equally weighting a basket of sector



Equally weighting a basket of sector stocks reduces the idiosyncratic component of risk compared to a market cap weighted basket.

stocks reduces the idiosyncratic component of risk compared to a market cap weighted basket with the five largest companies on average driving only 13% of the sector's total risk (figure 6).

Across the nine market cap weighted sectors studied, the largest stock's weight ranges from 8.8% to 30% and five of the market cap weighted sectors have over half their weight in only five stocks (figure 7).

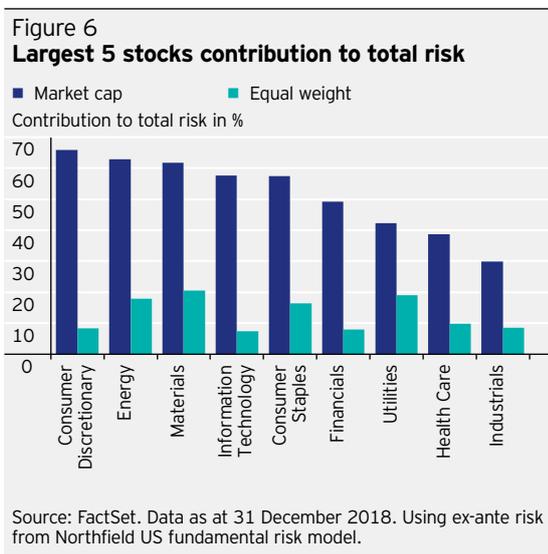
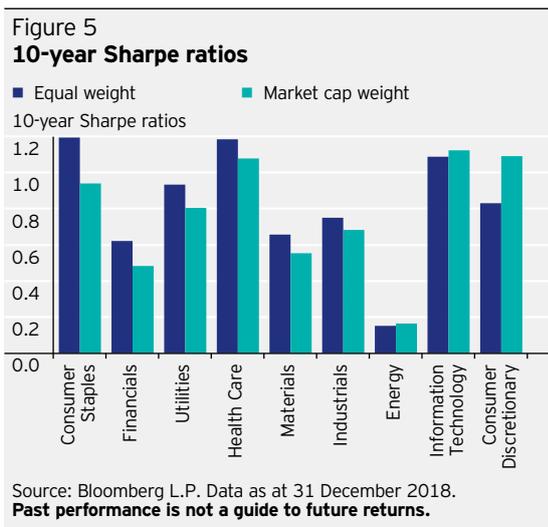
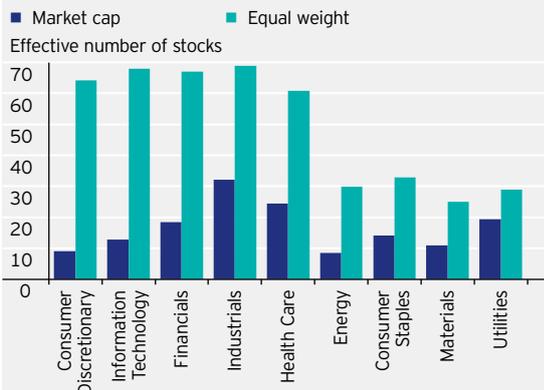


Figure 9
Equal weighting provides exposure to more companies



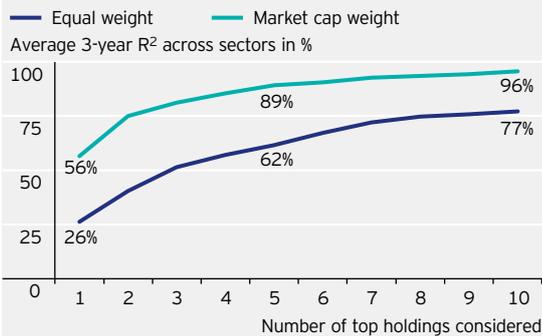
Source: FactSet. Data as at 31 December 2018.

We observe this trend of high idiosyncratic risk within the market cap weighted S&P 500 sectors. For example, in December 2012, 21% of the S&P 500 Information Technology Index was invested in one tech company. During this time, the stock was down 9%, resulting in the sector producing a negative return; the equal weight sector had a 1.3% investment in this company and was up 4.4% (figure 8). Below, we will further examine the pitfalls of market cap weighting sectors and the benefits of using an equally weighted approach across the sectors.

These large allocations to single stocks dramatically reduce the effective number of stocks that drive the basket's return. Applying the effective number of stocks calculation² across the S&P 500 market cap weighted sectors sheds light on the lack of diversification when the sectors are market cap weighted (figure 9). For example, market cap weighting the Consumer Discretionary sector effectively leads to only nine stocks driving the sector's return. This diversification problem can be remedied by equally weighting the sector. Equal weighting the Consumer Discretionary sector raises the effective number of stocks in the basket to 64. Equally weighting the other sectors also improves diversification compared to their market cap weighted peers.

Over the past 3 years, on average over half the return of the MCW sectors was explained by the largest stock in the sector while equally weighting improved the diversification with only 26% explained by the largest stock.

Figure 10
Equally weighting sectors reduced single stock risk



Source: FactSet. Data period: 31 December 2015 to 31 December 2018. Displaying the average R-squared across the sectors. R-squared is calculated using the contribution to return of the largest stocks compared to the sector's return.

These high concentrations found in the market cap weighted sectors result in most of the basket's return being explained by only a handful of names in the sector. Over the past 3 years, on average, over half the return of the MCW sectors was explained by the largest stock in the sector while equal weighting improved the diversification with only 26% explained by the largest stock (figure 10).

Table 2 displays the percent of the sector's return based on its largest holdings. The vertical axis increments represent the number of top holdings that are considered in the calculation. For example, over the past three years, 90% of the Financials sector return has been explained by its largest three names. Equally weighting the stocks in each sector dramatically reduces the impact of the sector's return explained by only a few names. Equal weighting provides effective exposure to all the companies in the sector instead of just a few when market cap weighted. This is a key advantage to investors who are trying to get exposure to the broad sector and not just a handful of names.

The ten-year volatility of the S&P 500 Equal Weight Index is 2.0% higher than the S&P 500 Index (15.6% vs 13.6%), while the volatility spread between market cap weighted and equal weight is less than 2% for seven of the nine analyzed sectors (figure 11). This reduced spread is due to the lower idiosyncratic risk from mega-cap stocks in equal weighted sectors versus market cap weighted. The Energy sector has the largest difference in volatility between the two weighting approaches. Its wide spread is driven by a 22% weight to a single large energy company in the market cap weighted sector and 3.2% in equal weight. This company has a 10-year volatility of 17%.

Equal weight sector for tactical rotation

Equal weighting offers broad exposure to all the companies in the sector instead of concentrated exposure to mega cap companies, which may help a tactical sector rotation strategy. Equal weighting's smaller market cap tilt leads to six of the nine sectors having 10-year betas above one. These higher betas enable a sector rotation strategy to capture more of the sector's movement (figure 12).

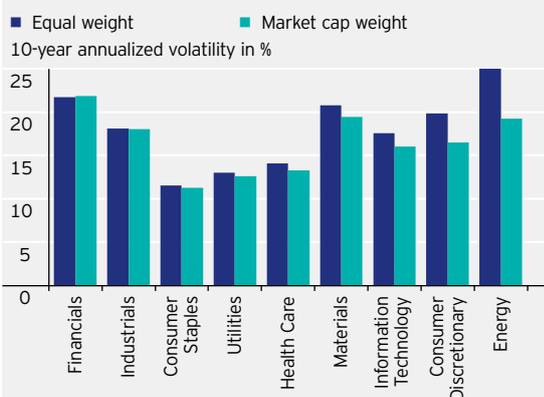
Table 2
Percentage of sector's return explained by top holdings

Number of largest stocks	Market cap weighted									
	Energy	Materials	Industrials	Consumer Discretionary	Consumer Staples	Health Care	Financials	Information Technology	Utilities	
1	70	73	25	68	50	32	63	58	69	
2	84	81	48	78	69	57	85	82	89	
3	89	80	67	86	75	67	90	86	89	
4	92	84	73	89	77	79	94	90	91	
5	94	85	82	89	90	85	95	91	93	
6	96	88	83	89	90	88	96	92	95	
7	97	91	87	89	94	91	96	94	96	
8	98	92	89	90	96	90	96	95	97	
9	98	93	91	91	96	92	96	96	97	
10	98	95	93	93	97	93	97	97	99	

Number of largest stocks	Equal weighted									
	Energy	Materials	Industrials	Consumer Discretionary	Consumer Staples	Health Care	Financials	Information Technology	Utilities	
1	39	51	39	16	18	46	21	0	7	
2	46	57	58	27	35	69	34	15	23	
3	57	66	55	30	66	67	50	26	45	
4	63	68	62	37	70	65	58	28	62	
5	67	72	76	40	70	71	62	33	66	
6	79	75	78	48	71	74	63	41	77	
7	80	75	81	53	82	76	66	52	82	
8	82	80	85	54	83	78	67	57	86	
9	82	78	85	55	84	80	71	57	88	
10	86	79	84	57	83	85	71	58	90	

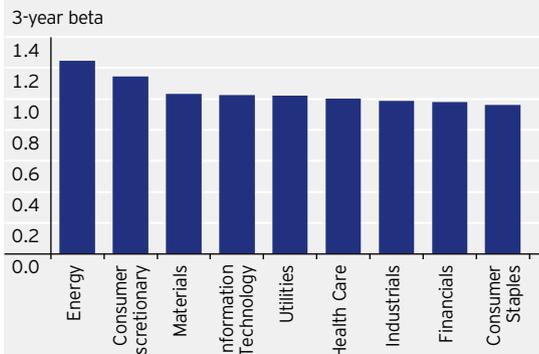
Source: FactSet. Data period: 31 December 2015 to 31 December 2018. Displaying the R-squared of the contribution to return of the largest stocks compared to the sector's return. The color shading spans from green, which are sectors with a low diversified R-squared to red, which are sectors with a high concentrated R-squared.

Figure 11
Sector volatilities of equal weight vs market cap weight



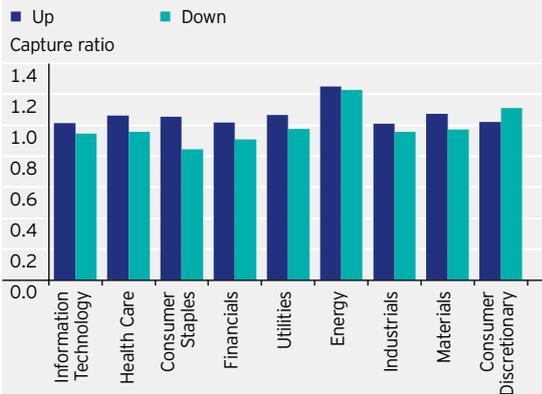
Source: Bloomberg. Ten-year annualized volatilities of the equal weight and market cap weighted S&P 500 sectors as at 31 December 2018. Volatility is measured by standard deviation of monthly returns.

Figure 12
Six equal weight sectors have betas above one



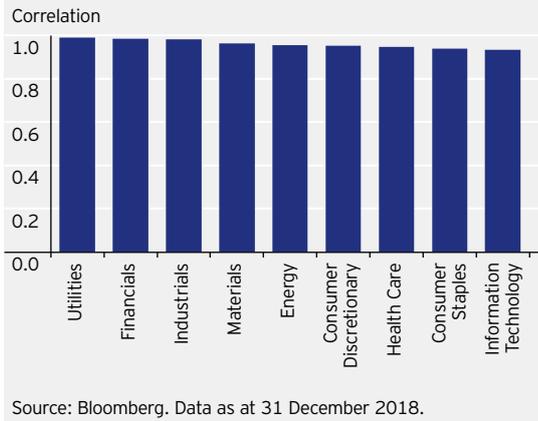
Source: Bloomberg. Data period: 31 December 2008 to 31 December 2018. The betas displayed are for the equal weight sectors and are relative to their market cap equivalent.

Figure 13
Equal weighted sectors offered improved up/down capture ratios



Source: Bloomberg. Data period: December 2008 to December 2018. Up and down capture ratios are for the equal weighted sector relative to its market cap weighted equivalent.

Figure 16
10-year correlation of EW to MCW



Source: Bloomberg. Data as at 31 December 2018.

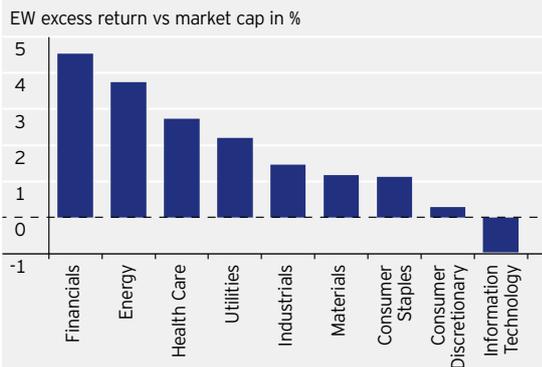
Over the past 10 years, all of the equal weighted sectors studied, captured more upside than their market cap weighted peers. The added diversification of equal weighting offered better downside participation with seven of the sectors having down capture ratios below one. In other words, most of the equal weight sectors were able to participate in more of the markets upward movement than they gave up on the downside (figure 13).

During periods of decreasing volatility, measured by the CBOE VIX Index, nearly all of the equally weighted sectors outperformed the market cap weighted sectors (figure 14).

However, this is not the case during periods of rising uncertainty. During periods of increased volatility, the average excess returns of equal weight sectors versus their market cap weighted counterparts were mixed (figure 15).

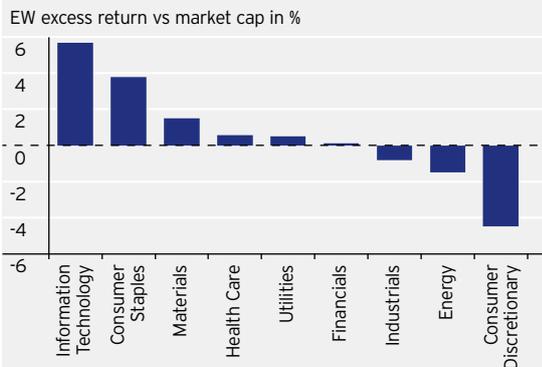
Equally weighting sectors may provide improved diversification and an enhanced return profile while maintaining correlation with market cap weighted sectors. All the sectors studied have equal weight to market cap weighted correlations above 0.93 (figure 16).

Figure 14
Decreasing volatility market environment



Source: Bloomberg. Data period: 31 December 2008 to 31 December 2018. Median annualized quarterly excess returns of equally weighted versus market cap weighted are shown for quarters when the CBOE VIX Index decreased.

Figure 15
Increasing volatility market environment



Source: Bloomberg. Data period: 31 December 2008 to 31 December 2018. Average annualized quarterly excess returns of equally weighted versus market cap weighted are shown for quarters when the CBOE VIX Index increased.

Key advantages of equal weighting over market cap weighting

- Equally weighting the S&P 500 results in tilts to smaller cap, higher volatility companies and a tilt away from momentum. Historically, it has performed best in lower risk environments.
- Splitting the S&P 500 into its sectors increases the concentration of the top holdings in the portfolios. This problem can be mitigated by equally weighting the sectors.
- Six of the nine equal weight sectors have had higher betas than their market cap peers, which may be beneficial for tactical sector rotation strategies.
- Despite equal weight's tilt towards smaller cap companies with higher volatility, seven of the nine equal weight sectors have had lower downside capture ratios than their market cap equivalents

due to the increased diversification resulting from the higher effective number of stocks in the portfolio.

- The equal weight sectors have had high correlations to their market cap peers, thus providing an effective means of gaining broad exposure to all the companies within the sector, not just a handful of the largest stocks.

For investors who manage sector allocations, whether strategically or tactically, the increased diversification and factor tilts of equal weight sector portfolios could be compelling. Others who employ market cap sector weights can still benefit from reduced concentration and imbedded factor tilts. While no panacea, these options are examples of factor strategies that could play a valuable role in pursuing an overall investment strategy.

About the author



Brad Smith, CFA

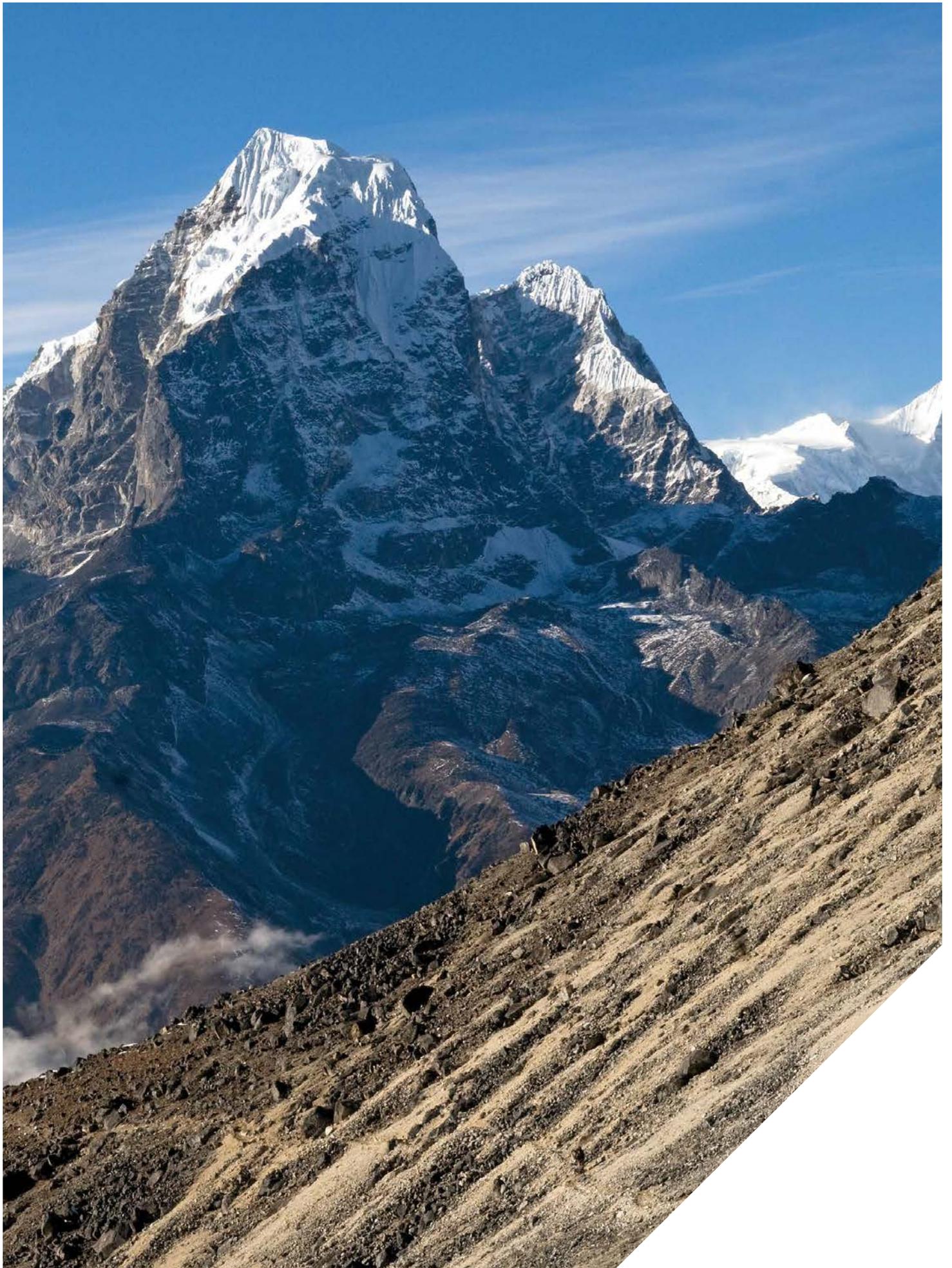
Senior ETF Research Analyst,
Invesco ETFs

Brad Smith works within Invesco's exchange traded funds (ETF) product and research group providing research, thought leadership and analysis on Invesco ETFs and the ETF industry.

Notes

- 1 Introduction to factor investing - the balance between risk and return efficiency, Invesco, 2017.
- 2 To measure the effective number of stocks in a portfolio, we use the Herfindahl index approach of taking the reciprocal of the summed squared weights. An equal weight portfolio will have an effective number of stocks equal to the number of stocks in the portfolio, while a portfolio with a large weight in a single stock will show a lower effective number of stocks than the actual number of stocks in the portfolio. An extreme example of this measure would be a portfolio of 100 stocks with 99% of its weight in one stock. Such a portfolio would effectively have only one holding, while a portfolio with 1% spread across 100 stocks will effectively be invested in 100 stocks.

Portfolio weights	Squared	Portfolio weights	Squared
99%	98%	1% × 100	0.01% × 100
1% × 99	0% × 99		
Sum of squared weights	99%		1.00%
Effective number 1/99%	1.0	1/1%	100.00



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