Integrating Sustainability with Factor-Based Investing

Global Systematic Investors

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For Financial Adviser Use Only

Executive Summary

There has been widespread adoption of sustainable approaches investing over recent years. The PRI (Principles of Responsible Investing), an UN-backed association promoting sustainable investing, now has close to 2,000 signatories, representing over $80 trillion of assets.[1] Investors are now increasingly expecting their asset managers to offer strategies that incorporate sustainability considerations.

This paper aims to provide some background context on the topic of sustainable investing as well as setting out a factor-based investment strategy that incorporates sustainability considerations in its asset allocation.

Investors have historically been somewhat reluctant to adopt a sustainable investing approach due to performance concerns. Many studies have shown that this concern is misplaced. We review some of this research in this paper. In summary, there is no evidence to support a performance penalty. If anything, published studies tend to support a positive relationship between sustainability and company financial performance.

Our goal is to design a global equity strategy for developed markets incorporating the following features:

- a significant tilt to mid/small cap companies in each region
- exposure to a blend of value/profitability metrics
- a high level of diversification across countries, sectors and stocks.
- integration of sustainability/ESG considerations.
- suitable for a core equity allocation,

We introduce the environmental, social and governance (ESG) data that we use and then discuss various issues that need to be addressed before integrating ESG scores with factor tilts in a portfolio. We then briefly introduce the factors that we use to provide the factor tilts in the strategy and then show how we integrate the ESG scores with the factor tilts as well as examining some key portfolio characteristics. Finally, we show our back-tested results from integrating ESG with the factor tilts.

By carefully managing the key factors and characteristics that drive expected return and risk, we believe that the proposed strategy should exhibit a similar return and risk profile to a factor-based investment strategy that does not incorporate sustainability and could provide core exposure to global developed equity markets.

[1] www.unpri.org

Introduction

The effect that humanity's activity has on our planet is becoming increasingly apparent. The consequences of our growing consumption of natural resources now threatens the future not just of other species but of our own as well. Many governments have recognised the danger and have begun to implement regulations to try to reverse this trend. Companies, organisations, and individuals are also changing their behaviours, partly in response to new regulation but also to be part of the solution, rather than contribute to the problem.

The investment community has been amongst those addressing the issues. There is a growing number of investment strategies designed to deal with environmental issues, social issues, ethical concerns, or governance structures. There have, of course, been many different iterations of responsible investing going back decades. The difference now is that there is a focus on the consequences to society of the activities of companies into which we, as investors, commit our clients' capital.

In this article we explain how sustainable investing can be incorporated into a well thought out, factor-based approach without compromising on risk or return objectives. The idea is simple: classify companies in terms of how they manage their environmental, social, and governance responsibilities, then favour those that score well over those that score poorly. Combine this process with a factor-based approach and the result is a win for investors and society.

Unfortunately, implementing the idea is not simple. Even with a standard factor-based approach the components do not always work together. Incorporating a set of sustainability considerations adds more complications. We integrate sustainability while preserving the risk and return characteristics of the investment strategy. In doing so, we have created a sustainable investment approach that is suitable for a core investment allocation.

In this paper we provide some background context on sustainable investing and provide a brief review of some of the literature on the performance of sustainable investing strategies, as well as the more direct relationship between sustainability and corporate financial performance. We review the historical data on sustainability and discuss issues that need to be addressed when incorporating this information into a quantitative investment process.

We then demonstrate how we integrate sustainability into our factor-based investment approach while preserving its risk and return characteristics. Finally, we provide back-tested simulation results of our strategy to support our belief that the expected return and risk of a strategy that incorporates sustainability should be similar to that of a factor-based strategy that ignores sustainability.

Background

The earliest forerunners of sustainable investing were those concerned with moral or ethical issues. These were often sponsored by religious groups who did not want their capital to be invested in companies associated with, for example, alcohol production and distribution, weapons manufacture, or gambling. Similar investments were introduced to a broader market with the development of socially responsible investment strategies (SRI).

More recently environmental and governance issues have been added to social concerns, resulting in a more comprehensive approach to measuring environmental, social, and governance (ESG) behaviours. There have been shifts in key areas that have promoted ESG investing from the margins to the mainstream. First, government regulation has been introduced to cover areas such as renewable energy targets and higher taxes on polluting vehicles. In addition, governments have agreed on global goals and timeframes. Second, consumers are becoming more engaged. The influence of the media in highlighting the negative effects of plastic use, poor water management, fast fashion, etc. has had a profound effect on consumer preferences. Third, the investment world has begun to take a far greater role in influencing companies' behaviour.

We are now in a situation where government regulation is promoting better ESG outcomes, more engaged consumers are demanding better ESG outcomes, and an increasing number of asset managers are pushing for better ESG behaviours from the companies they invest in. It is an exciting and challenging time but, for investors, it also throws up a bewildering array of new choices.

What is Sustainable Investing?

We define sustainable investing as a long-term investment strategy that incorporates environmental, social, and governance considerations into the investment process. To appreciate the scope of sustainable investing, it is necessary to have some knowledge of the ESG components. Each ESG component - environmental, social, and governance – is made up of several constituent criteria. A company's management of its ESG responsibilities is measured by aggregating its scores on each of the components. The following are examples of the criteria relevant to each of the ESG components.

Exhibit 1: ESG Components

Environmental	Social	Governance
Climate change and carbon emissions	Gender and diversity	Board composition
	Human rights	Executive compensation
Air and water pollution	Labour standards	Audit committee structure
Energy efficiency	Employee engagement	Bribery and corruption
Waste management	Customer satisfaction	Lobbying activities
Water Scarcity	Community relations	Political contributions
Biodiversity and deforestation		

Source: "What's in a name? The Many Dimensions of Sustainable Investing", Morningstar 2017.

Current ESG components cover a wide range of areas, some of which are less relevant to one company versus another. For example, air and water pollution will be an important element in measuring the environmental impact of a power-generation utility. The same element will have less bearing on a technology company. Nonetheless, the broad scope of all the constituent elements means that current ESG coverage is relatively comprehensive.

Having understood the ESG components and their constituent elements, it is now possible to look at the different approaches to sustainable investing. The three main approaches are: Investor directed; Exclusion-based; and Inclusion-based. Each approach captures sustainable investing differently and, consequently, each has a different outcome.

Approaches to Sustainable Investing

Investor directed investing includes impact investing and active ownership. This approach tends to be very focused and can be limited in terms of investment opportunities. Impact investing, for example, seeks to make a direct impact on a specific area of concern, such as reducing third world infant mortality. In this instance, the investment would focus on companies working on solutions to infant mortality. To accomplish this goal, the underlying investments may have to be unlisted firms requiring a private equity investment. This approach tends to be the most concentrated of the three.

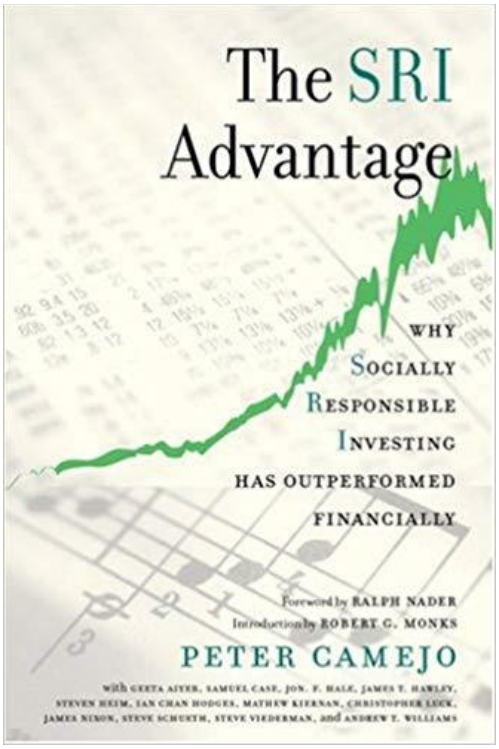
Exclusion-based investing, as its name suggests, involves screening out firms that do not satisfy the necessary ESG criteria. The number of companies excluded will depend on the ESG criteria. For example, all oil and coal producers, along with related supplier and distributer companies, might be excluded from an investment that excludes fossil fuel producers and suppliers. There are plenty of listed investment opportunities that satisfy this type of approach, so these investments are generally liquid and of significant size. However, depending of the number of exclusions, this approach can still result in very concentrated portfolios.

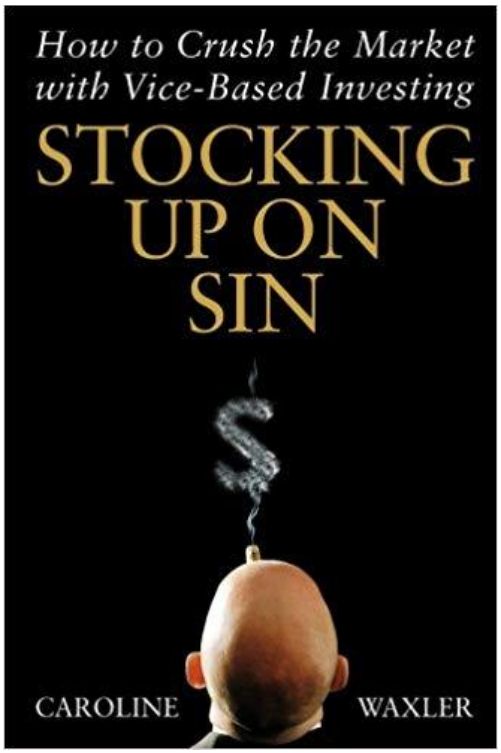
Inclusion-based investing is the most diversified of the three approaches. The starting point is the eligible universe of companies for the strategy. A simple example might be a global equities strategy investing in companies listed on exchanges in developed markets around the world. An inclusion-based approach applies the sustainability criteria to this universe through adjusting the weights of the constituent companies, increasing investment in more sustainable companies and reducing investment in less sustainable firms. Companies with extremely poor sustainability records may be excluded but, typically, all sectors are represented. This can be considered as a best-in-class approach as it leads to a well-diversified portfolio with sensible portfolio characteristics.

We use an inclusion-based investment approach when integrating sustainability with a factor-based investment. This allows us to maintain a high degree of diversification and to preserve the risk and return characteristics of the factor-based strategy.

Sustainable Investing and Performance

A key issue when considering the inclusion of sustainability in the choice of investments is whether there is likely to be an impact, either positive or negative, on investment returns. There are two main schools of thought on this issue, which are summed up on the covers of two books in this area shown below.





The first school of thought, represented for example by the book *The SRI Advantage* by Peter Camejo, maintains that there is a positive relationship between sustainability (or SRI etc.) and company performance. This could be because having a sustainable business approach puts a company ahead of the curve in terms of regulatory changes, shifts in consumer tastes and industry practice. Perhaps such an approach confers wider advantages on a business and could signal better management practices in general. Another benefit could be that engaging with companies to improve their sustainability approach leads to a positive stock market reaction and an improved share price.[2]

The other side of the argument, represented for example by Caroline Waxler's *Stocking up on Sin*, argues that in fact there can be high returns from investing in so-called "sin" stocks. One reason for this could be that certain industries that are considered socially irresponsible, e.g. tobacco, could have a high barrier to entry as well as significant risk due to potential health claim liabilities. As long as the liabilities are not too severe, such companies can deliver healthy and stable profits. More broadly, if a significant number of investors choose not to own certain stocks for reasons unrelated to financial return, there will then be fewer investors ready to buy them. Those investors who are prepared to hold them will then need to be offered a higher return for doing so since they would be increasing their risk. One of the first papers along this line of argument was Hong and Kacperczyk 2009 who looked at the cost of excluding so-called sin stocks from portfolios and argued that such exclusion would lead

[2] See for example Dimson, Karacas and Li, 2015 and 2018.

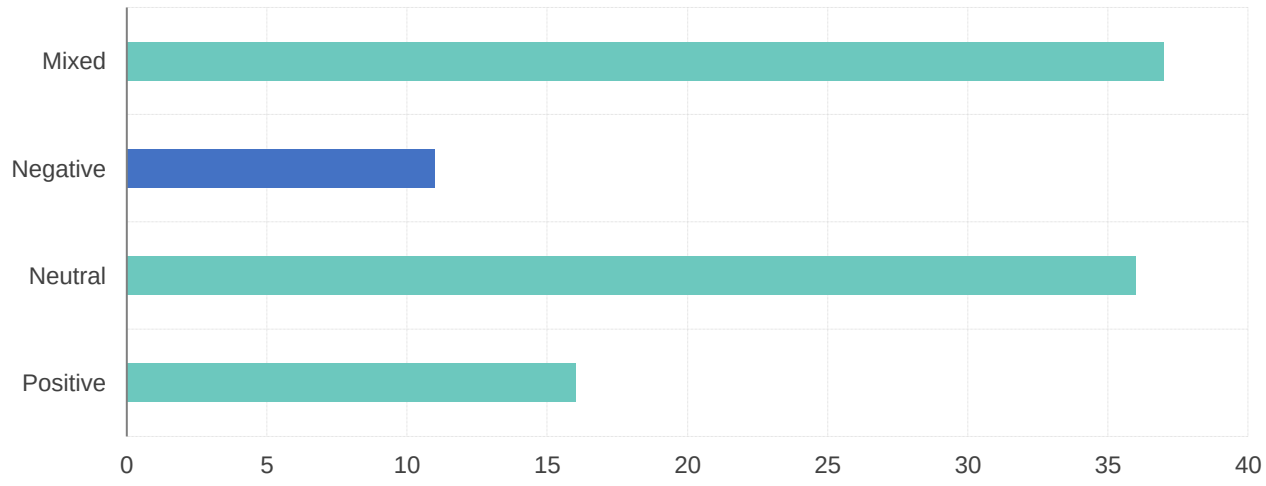
to higher returns of sin stocks in general. For a recent summary of this kind of argument see Asness 2017.

Rather than becoming mired in these arguments, we briefly survey the research in this area.[3] We first look at studies of funds that add sustainability to their investment criteria and at the returns of some investment strategies on each side of the ESG/returns debate. Then we look at some of the company-level research on sustainability and financial performance. Later in the paper, we conduct our own assessment of the impact of integrating ESG information into a diversified factor-based investment strategy.

Fund Performance Studies

One strand of the literature examines the performance of funds that follow a sustainable or SRI approach and compares them to other funds that do not – typically conventional active funds. No single study will provide convincing evidence on this topic. However, several so-called meta-studies exist in this area that review a wide range of primary studies on a common theme. One meta-study by Revelli and Viviani (2015), which reviewed 85 primary studies, found no significant relationship between sustainability and performance. An even more extensive meta-study was published by Friede et al. (2015). Its main findings are summarised below in Exhibit 2 which shows the proportion of studies that find a relationship between sustainability and fund performance. Friede et al. conclude that more than 70% of the studies included in their analysis report mixed or neutral results. Of the remaining studies they reviewed, somewhat more demonstrate a positive rather than a negative performance impact.

Exhibit 2 Sustainable/Responsible Fund Performance Study Outcomes



Source: "ESG and Financial Performance: Aggregated evidence from more than 2000 empirical studies", Friede G., Busch T. and Bassen A., Journal of Sustainable Finance and Investment, 2015

[3] A recent overview of research on this topic was provided by John Hale, Head of Sustainability Research at Morningstar (Hale 2016).

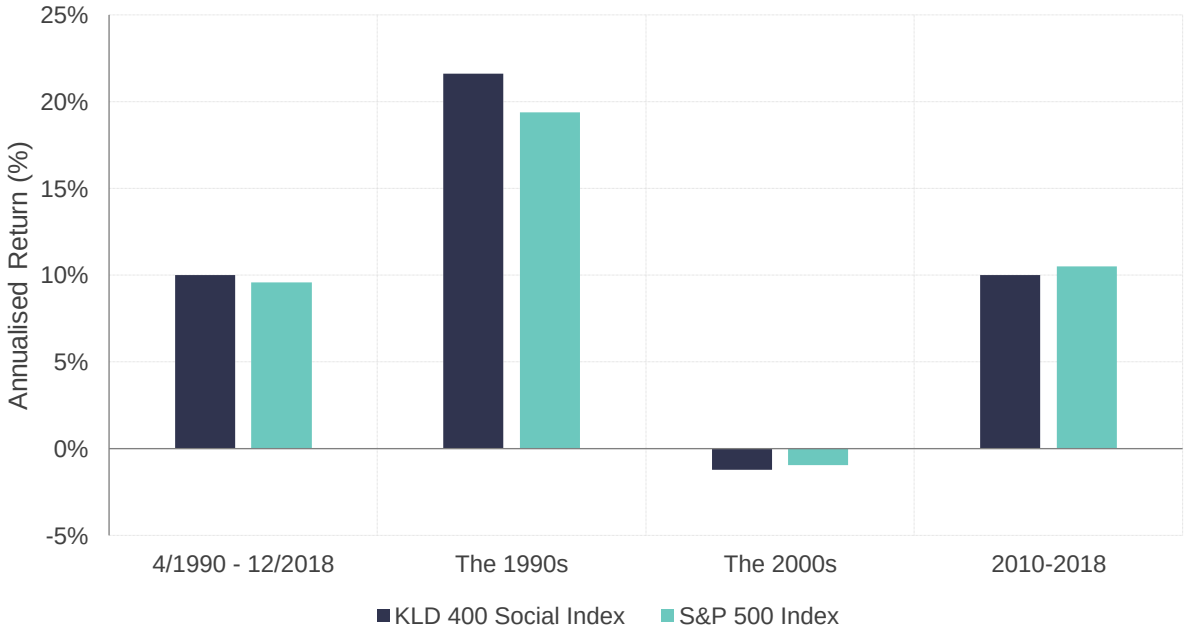
In general, it seems that there is no reliable evidence based on fund studies to conclude that the inclusion of sustainability in the investment process either enhances or detracts from fund performance.

Sustainable Indices

Another perspective on the performance of sustainable investment strategies is provided by the historical performance of sustainable equity indices. The longest-running example of this is the MSCI KLD 400 Social Index. This index was launched in May 1990 as the Domini 400 Social Index and it was one of the first SRI indexes (as part of the RiskMetrics Group, KLD was acquired by MSCI in 2010). The investment objective of this index is to track 400 large/mid cap companies in the US that have high ESG ratings. It excludes companies whose products have negative social or environmental impacts.

The relative return of this index compared to the S&P index is shown in Exhibit 3 below for various time periods. Since inception, this index has slightly outperformed the S&P 500 index and its returns have been close to the S&P 500 in each of the last three decades. On this basis, there is little evidence that higher ESG stocks suffer a performance penalty.

Exhibit 3 MSCI KLD Index vs. S&P 500 Index



Source: FactSet.

At the other end of the spectrum regarding sustainability and performance are funds that explicitly target the potentially higher returns of socially undesirable companies. A well-known example of this is the VICE fund managed by US Mutuals. The factsheet for this fund states *"The Vice Fund is designed for investors seeking to capture better long-term risk-adjusted returns than the S&P 500 Index by investing in stocks within industries that demonstrate significant barriers to entry, including alcoholic beverages, defense/aerospace, gaming and*

tobacco industries". The performance of this fund since its inception in 2002 relative to the S&P 500 Index is shown in Exhibit 4 below. Whilst the fund outperformed the index until the end of 2017 it has since lost all of that outperformance and now slightly lags the index. Although it's far from being a scientific test, this nonetheless highlights the difficulty of supporting claims for or against the impact of sustainable criteria on investment returns.

Exhibit 4 VICE fund vs S&P 500 Index

This chart illustrates the performance of a hypothetical $10,000 investment made in the Fund on August 30, 2002 following its inception. Assumes reinvestment of dividends and capital gains, but does not reflect the effect of any applicable sales charge or redemption fees. This chart does not imply any future performance.

Source: USA Mutuals - https://usamutuals.com/vice-fund/

In summarising evidence from studies of sustainable funds and indices, John Hale of Morningstar states: *"The weight of academic research on the performance of sustainable/responsible portfolios, mutual funds, and indexes suggests that there is no performance penalty associated with sustainable investing"*.[4]

Whilst these reviews are useful, there are issues with fund studies as an assessment of ESG inclusion. There are additional costs associated with active management in general which could detract from the performance of sustainable funds compared to indices. Focussing exclusively on sustainability in a fund might also reduce diversification or induce regional or sector biases. Moreover, factor exposures such as size or value could be altered which in turn could affect the expected return of portfolios. Hence, these kinds of studies do not provide as clear a picture as one might like of the link between sustainability and performance. A more direct way of assessing this link is to look at studies that test for an association between sustainability and company-level performance and/or risk which is what we turn to next.

[4] Hale 2016, p3

Sustainability and Financial Performance

There is a large and growing literature on the link between sustainability and company financial performance. Data availability has been an issue in this area in the past. However, there are now numerous providers of databases of comprehensive ESG information or more specialised data on environmental, social or governance criteria. This offers researchers the ability to carry out more detailed company-level analyses and allows them to apply appropriate controls for factor exposures and risks when assessing relative returns.

Several recent studies argue that there is an association between higher ESG ratings and a lower cost of capital – see for example Fulton et al. 2012; Eccles et al. 2014; Arabesque Partners & Oxford University 2015 (a review of 200 studies); Friede et al. 2015 (review of 2000 studies); El Ghoul et al. 2016; Khan et al. 2016. Some of these studies also demonstrate a link between higher ESG ratings and company operating performance, e.g. profitability or return-on-equity, as well as higher stock price returns.

A widely cited paper in this area by Eccles et al. 2014 compares 180 US companies that voluntarily adopted sustainability policies by 1993, which they call *High Sustainability* companies. They compare these to a matched sample of *Low Sustainability* companies. The High Sustainability companies have better governance practices and stakeholder engagement, are more long-term oriented and have higher transparency for non-financial information. They provide evidence that High Sustainability companies outperform their counterparts over the long-term, both in terms of stock price performance and corporate financial performance. Over the 18-year period from the beginning of 1993 to the end of 2010, a portfolio of the High Sustainability companies (weighted in proportion to their market capitalisation) would have outperformed the corresponding Low Sustainability portfolio by 2.4% per annum.[5]

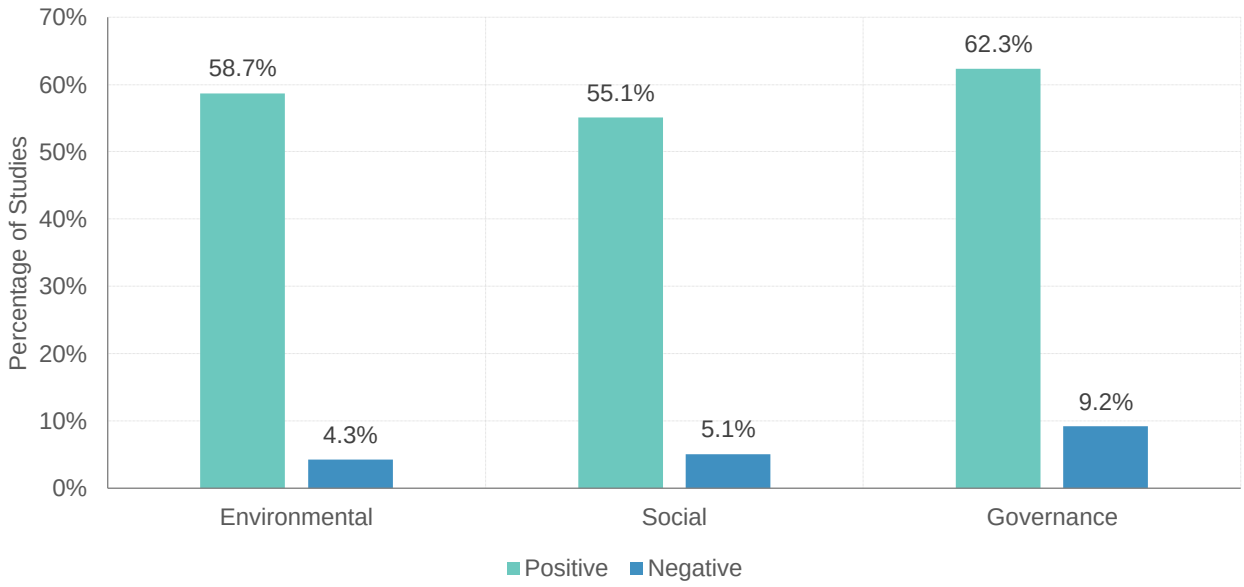
Some studies demonstrate an association between higher ESG ratings and higher credit ratings (see e.g. Bauer and Hann 2010; Attig et al. 2013). Other studies show a link between higher ESG ratings and lower downside risk and volatility (see e.g. Glossner 2017; Dunn et al. 2018).

There are also some meta-studies that review the many company-level studies on the impact of ESG ratings and corporate financial performance. The most extensive of these meta-studies is Friede, Busch and Bassen (2015) study mentioned earlier.

One of their reviews looked at the link between each of the individual ESG components (namely environmental, social and governance factors) and corporate financial performance. A summary of these results is shown in Exhibit 5 below. Based on 644 primary studies, Friede et al. report that the majority of them show a positive relationship between individual environmental, social and governance scores and corporate financial performance.

[5] Eccles et al. 2014, p18

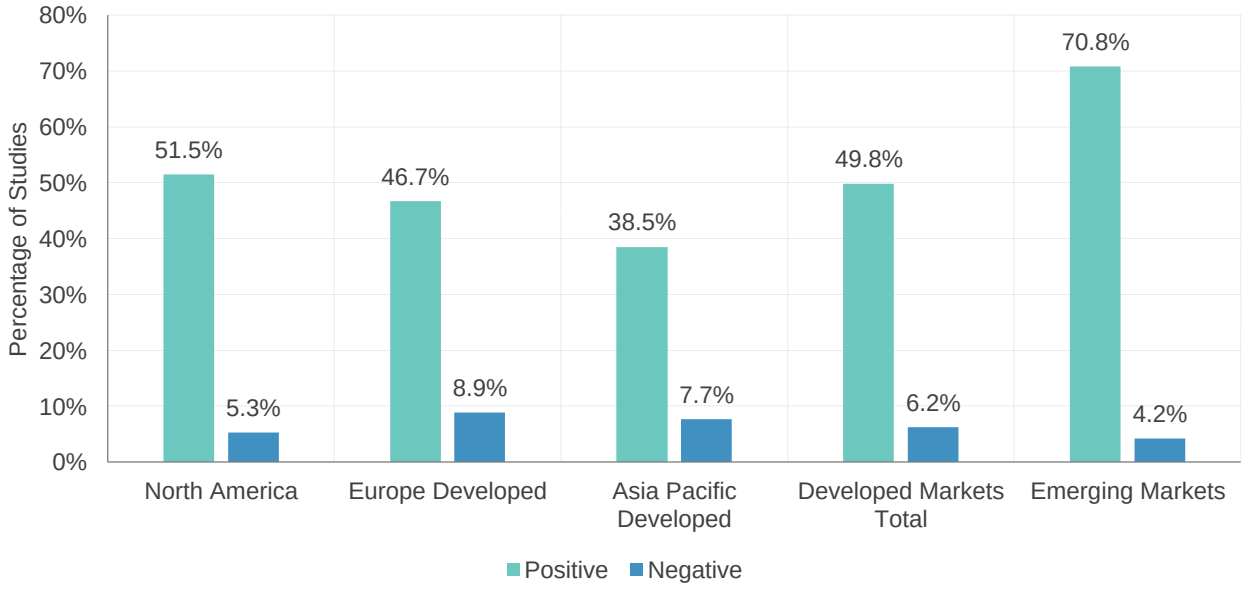
Exhibit 5 Environmental, Social and Governance categories and their relation to corporate financial performance



Source: "ESG and Financial Performance: Aggregated evidence from more than 2000 empirical studies", Friede et al. 2015

Friede et al. also examine the relation between ESG and corporate financial performance across different regions to see how consistent the relationship is around the world. These results are summarised in Exhibit 6 below.

Exhibit 6 ESG relation to corporate financial performance per region



Source: Friede et al. 2015

Based on 402 studies Friede et al. report that the majority of studies in each region show a positive relationship between ESG scores and corporate financial performance.

Friede et al. state: *"The orientation toward long-term responsible investing should be important for all kinds of rational investors in order to fulfil their fiduciary duties and may better align investors' interests with the broader objectives of society. This requires a detailed and profound understanding of how to integrate ESG criteria into investment processes in order to harvest the full potential of value-enhancing ESG factors."*[6]

Moreover, in summarising his review of the literature on sustainable investing research, Hale says: *"For investors interested in sustainable investing, the research implies they can receive competitive performance while also addressing their sustainability concerns."*[7]

Caveats

In general, our view is that investors should be somewhat wary of claims of excess returns from ESG. A key challenge is the limited historical availability of ESG data, which restricts the period over which one can reliably test the effect of ESG inclusion – especially outside the US. For example, Sustainalytics only has good data coverage across developed markets for the last 10 years even though they are one of the industry leaders in this area. This period is not long enough to test the effect of ESG inclusion over different economic cycles.

Another reason to be wary is that there is likely to be a publication bias towards finding a positive link. That could explain the high proportion of positive findings in the Friede et al. reviews. Note that in the financial economics literature, there are more than 300 factors purported to be associated with higher returns. It seems highly unlikely that all these factors are truly robust and will persist in the future.[8] Similarly, in the ESG literature, is possible that many of the published findings lack statistical robustness.

Moreover, there is currently a significant shift occurring in the investment industry towards increasing recognition of ESG concerns and the adoption of ESG considerations in portfolio construction across different investor types, both retail and institutional. As this shift continues, companies with stronger ESG credentials will benefit and their share prices may rise accordingly. So at least some of the outperformance observed in ESG studies could be related to this flow effect and might not necessarily indicate that there is a longer-term advantage from ESG inclusion.

An additional issue with studies on ESG and performance is that most of these studies precede recent advances in asset pricing research. For example, Fama and French augmented their Three-Factor Model to include additional factors related to profitability and investment in 2015.[9] This was after most of the papers in the Friede et al. review were published. There appears to be a positive link between ESG scoring and profitability.[10] However, the higher returns could mainly be related to profitability, and the ESG relationship

[6] Friede et al. 2016, p227
[7] Hale 2016, p 11
[8] For a critique of this, see Harvey et al. 2016 "… and the Cross-Section of Expected Returns".
[9] See Fama and French 2015.
[10] For example, see Eccles et al. 2014.

with returns could be somewhat incidental. Very few studies have properly dealt with these interactions and there is widespread debate as to whether there is simply a positive correlation between ESG and corporate performance or a more causal relationship.[11]

There is likely some merit to both sides of the ESG/performance argument. In his review of the research on this, Hale states: *"SRI exclusions may indeed be a drag on performance, as theory suggests, but ESG inclusion may have a positive effect. The two factors more or less offset each other, resulting in overall performance [of sustainable funds] about on par with conventional funds."*[12]

We believe that if an investor wants to target higher expected returns, then the most robust and effective way to do so is via the management of well-known factor exposures, while ensuring that a portfolio maintains diversification across countries, sectors and stocks. Our approach therefore is to design a set of factor-based exposures in a portfolio to target the higher expected returns associated with those factors. We then integrate the tilts to ESG while maintaining those targeted factor exposures and ensuring that those exposures are not diluted after the integration of the ESG tilt. We describe these steps in the next section.

Combining Sustainability with a Factor-Based Investing Approach

We now turn to the task of integrating sustainability with a factor-based investing strategy. Our goal is to design a global equity strategy for developed markets incorporating the following features:

- a significant tilt to mid/small cap companies in each region
- exposure to a blend of value/profitability metrics
- a high level of diversification across countries, sectors and stocks.
- an integrated Sustainability/ESG overlay.

The box below shows some of the possible choices that can be made in portfolio design in terms of how one approaches ESG integration. On the left side are more diversified approaches which are suitable for core investment strategies. On the right are more concentrated approaches that might focus on specific ESG themes such as social impact investing, renewable energy, batteries, resource efficiency etc. These tend to be more specialised strategies involving concentrated portfolios and high tracking error levels with respect to broad market indices which are also more suitable as satellite strategies. Since our goal is to design a portfolio that is suitable for a core equity allocation, we choose an approach that provides tilts to return factors and higher ESG companies with a balanced exposure to both of these tilts, whilst maintaining broad diversification at the country, sector and stock levels.

[11] For an academic review of this point, seen Farzad Saidi 2014 **"**Unravelling responsible investment: A literature review".
[12] Hale 2016 p7

Exhibit 7 Core vs. Satellite approaches to ESG integration

Broad Thematic	**Narrow Thematic**
Broad universe	Narrow universe
Diversified	Concentrated
Suitable to core allocation	Satellite allocation
Lower tracking error	High tracking error

Increasing Tracking error

In the following sections we first introduce the ESG data that we use and then discuss various issues that need to be addressed before integrating ESG scores with factor tilts in a portfolio. We then briefly introduce the factors that we use to provide the factor tilts in the strategy and then show how we integrate the ESG scores with factor tilts as well as examining some key portfolio characteristics. Finally, we present our back-test results from integrating ESG scores with the factor tilts.

ESG Scores

There are numerous providers of ESG information that are used in financial markets. The major index providers such as MSCI, FTSE and S&P all offer ESG data, either internally or in partnership with third parties, on which they then base their ESG index products.[13] A key issue when deciding on an ESG provider is how extensive their coverage is – i.e. the number of companies they analyse and provide ESG scores for. Since we overweight smaller companies, it is important that our data provider has good coverage of the small cap segment.

Exhibit 8 below shows the coverage of various providers of ESG data across size groups. In the mega, large and mid-cap segments, covering the top 40%, next 30% and next 15% by value of market cap respectively, the coverage of all the providers is extensive since these are widely held companies that are typically constituents of major indices such as MSCI World, FTSE World etc. However, once we focus on smaller companies, the coverage of some of the providers tails off, especially for micro-cap companies.

Our chosen provider for ESG scores is Sustainalytics, a global leader in the provision of ESG related information. As the coverage table below shows, Sustainalytics provide somewhat higher coverage in small and micro-cap which ensures extensive ESG coverage across our investable universe of stocks.

[13] As previously mentioned, MSCI owns KLD. S&P owns Trucost.

Exhibit 8 Global ESG Coverage Statistics

				Weight Coverage % of Global Universe					Weight Coverage % of Size Group				
Size Group	Total % of Mkt Cap	Mcap Range £	No. of Firms	EIRIS ESG	GMI - Environ-mental	MSCI ESG	Sustain-alytics ESG	Trucost Carbon Footprint	EIRIS ESG	GMI – Environ-mental	MSCI ESG	Sustain-alytics ESG	Trucost Carbon Footprint
Mega	40	£40B-£500B	181	39.9	39.7	39.9	39.9	39.4	100.0	99.6	100.0	100.0	98.9
Large	30	£10B-£40B	584	29.3	29.4	29.9	30.0	29.5	97.5	98.0	99.7	100.0	98.2
Mid	15	£3.5B-£10B	983	13.7	14.2	14.6	15.0	14.0	90.7	94.1	96.7	99.2	92.8
Small	10	£1B - £3.5B	1,962	4.6	7.4	8.5	8.9	5.8	45.8	74.5	84.8	89.3	58.2
Micro	4	£250M-£1B	2,198	0.8	2.5	3.2	3.3	1.3	19.5	61.8	80.6	81.2	32.4
Tiny	1	< £250M	2,487	0.0	0.2	0.2	0.4	0.2	3.5	15.9	20.7	35.7	15.4
Total Universe	100	£50M-£500B	8,395	88.2	93.4	96.3	97.4	90.2	88.2	93.4	96.3	97.4	90.2
99% Universe	99	£250M-£500B	5,908	88.2	93.3	96.1	97.1	90.1	89.1	94.2	97.1	98.0	91.0

Exhibit 9 Sustainalytics Overview

Source: Sustainalytics

Sustainalytics provides ESG scores on more than 4,500 companies globally, which are evaluated within global industry peer groups. In addition, Sustainalytics tracks and categorizes ESG-related controversial incidents on more than 10,000 companies globally. We use both sets of data when we develop our internal ESG score which we describe in more detail below.

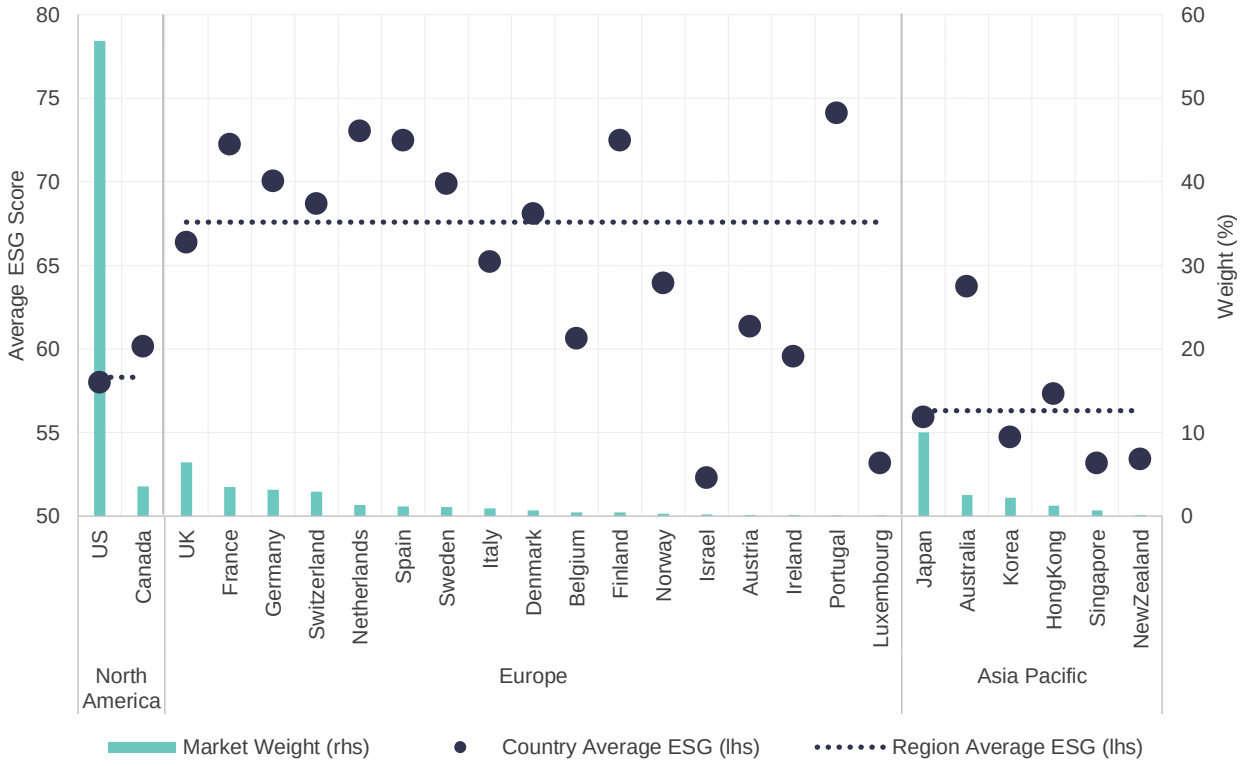
Adjusting ESG Scores

There are various issues that need to be taken into consideration when using ESG scores supplied by providers such as Sustainalytics. ESG scores usually differ across regions, countries, sectors and company size ranges. ESG scores may also be correlated with

valuation metrics or other characteristics that we might use to construct portfolios. A key consideration therefore is that we do not wish to alter our region, country or sector exposure too much by increasing our ESG exposure. We also do not wish to dilute our exposure to those factors that we believe are associated with higher expected returns such as size, book-to-market as well as other valuation or profitability metrics.

In Exhibit 10 below, we plot the average ESG score by country across each of the three key global developed market regions: North America, Europe and Asia Pacific. The grey bars show the weights of each country, the yellow dots show average ESG scores for companies in each country and the dashed lines show average ESG scores per region. There are clearly large differences in ESG scores across countries and regions. If we did not adjust for these differences, then adding ESG scores in our portfolio construction process would tilt our portfolio away from the North America and Asia Pacific and towards Europe.

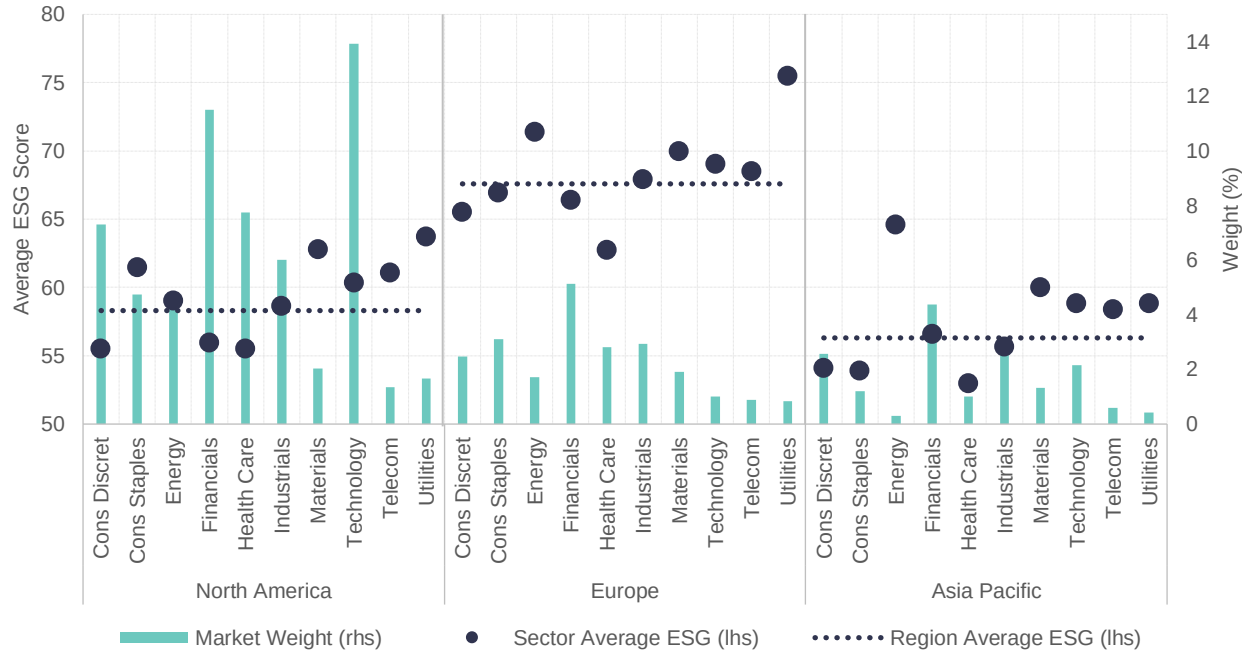
Exhibit 10 Average ESG Scores by Region and Country



Source: GSI, Sustainalytics.

There is also substantial variation in ESG scores across sectors within each region. Exhibit 11 below shows the average ESG score for companies in each sector across each of the three regions. Whilst we wish to tilt the portfolio towards higher ESG scoring companies, we do not want this to induce an unintended concentration in sectors with higher average ESG scores. Instead, we would like to tilt towards companies with higher ESG scores in each sector whilst maintaining sector diversification in the portfolio.

Exhibit 11 Average ESG score by Region and Sector



Source: GSI, Sustainalytics.

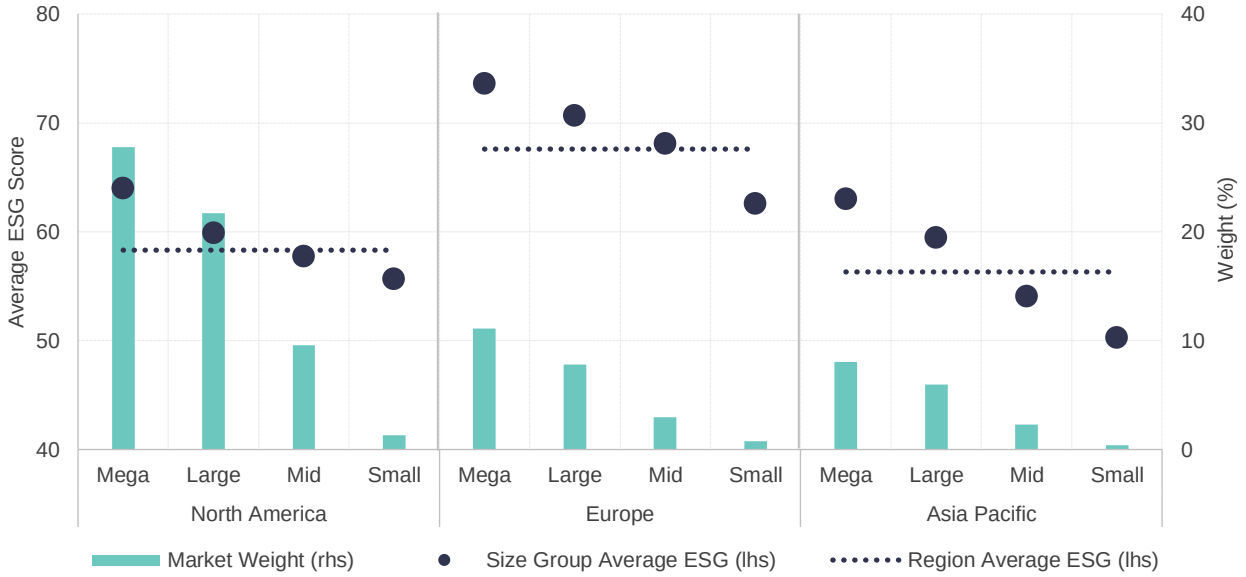
There is a very strong relationship between company size and ESG score. Exhibit 12 shows the average ESG score for each size group. In general, larger companies exhibit higher ESG scores than smaller companies. This could reflect true underlying sustainability behaviour of larger companies. For example, they are likely to have stronger incentives to improve their sustainability due to pressure from investors and other reputational concerns. However, this could also be a reporting issue in the sense that larger companies have the resources to produce the information and reports required to demonstrate sustainability to ESG data providers. Smaller companies, lacking such resources, might score less well due to these information and reporting limitations, not because they have intrinsically worse sustainability practices.

In our portfolio construction, we wish to generally overweight mid-cap and small-cap companies relative to larger companies. Therefore, we do not want a tilt to higher ESG companies to detract from our desired level of small-cap exposure. Instead we target higher ESG scoring companies within each size range, and we ensure that we maintain an overall tilt to smaller companies in the portfolio after we tilt towards the higher ESG scoring companies.

Portfolios that focus mainly on tilting towards higher ESG scoring companies are likely to miss this important feature and may induce a shift towards larger companies, thereby lowering expected returns. We wish to ensure that we maintain our desired exposure to small-cap stocks in the final portfolio. It is important to note however that our tilt towards smaller companies leads to a somewhat lower average ESG score that we might otherwise obtain if we ignored our size exposure and simply tilted toward high ESG companies regardless of the portfolio's overall size exposure. For example, Morningstar's overall portfolio ESG score,

which is based on Sustainalytics ESG scores, does not adjust for this important size effect in ESG scores.

Exhibit 12 Average ESG Scores by Region and Size Group



Source: GSI, Sustainalytics.

To summarise our modifications to the raw ESG scores supplied by Sustainalytics: we adjust the scores to account for differences across regions, sectors and size ranges. As a result, integration of ESG scores does not impact our portfolio's risk and return characteristics to shift that much from the portfolio that we would target before the integration of the ESG scores.[14]

One final component to mention in the ESG score adjustment is related to "controversy". Sustainalytics tracks and categorizes the exposure of companies to ESG-related incidents which they refer to as "controversies". Examples include mining disasters, regulatory breaches, consumer complaints, etc. The impact of such incidents is assessed for each company. The highest level of current involvement of a company across various types of ESG-related risks is also tracked. We also make an adjustment to the ESG score for the highest controversy level.[15]

[14] As we will show later, there will be some change in sector weights after the ESG scores are integrated.
[15] Details are available on request. Morningstar makes an adjustment at the portfolio level for the controversy level when they derive their fund sustainability scores.

Factor-Based Investment Strategy

Before we describe how we integrate the ESG scores in our investment process, we briefly outline our factor-based investment strategy.

Our goal is to give investors exposure to a range of well-understood factors that are strongly supported by the academic and practitioner literature. The factors that we principally seek exposure to are:

- Market factor - broad exposure to equities across global markets
- Size factor – smaller company stocks have higher expected returns than larger companies.
- Value factor – stocks trading at lower prices have higher expected returns compared to stocks trading at higher prices.
- Profitability factor – companies generating higher profits, on average, have higher expected returns.
- Momentum factor – this is captured passively

Each of these factors contributes independently to expected returns. We form a portfolio by first tilting towards smaller cap stocks whilst maintaining sector diversification. All stocks are ranked on a range of value and profitability metrics including book-to-market, EBITDA/Enterprise-Value etc. A composite value/profitability score, which we call a *Value Score* for simplicity, is formed for each stock based on these metrics. The size tilted portfolio is then tilted towards higher value stocks by increasing or decreasing company weights depending on the Value Score.

An additional feature is that the degree to which we tilt towards our value score is somewhat less for very large stocks and higher for smaller stocks. This way we avoid excessive under-weights or over-weights of very large companies relative to their market weights. It also means that our "active weight" in general is more evenly distributed across the size ranges of the portfolio leading.

We then combine our adjusted ESG scores with our Value scores. Thus, a stock with a higher value score and a higher ESG score will receive a higher weight; a stock with a lower value score and a lower ESG score will receive a lower weight; stocks that lie between those two extremes receive more neutral allocations.

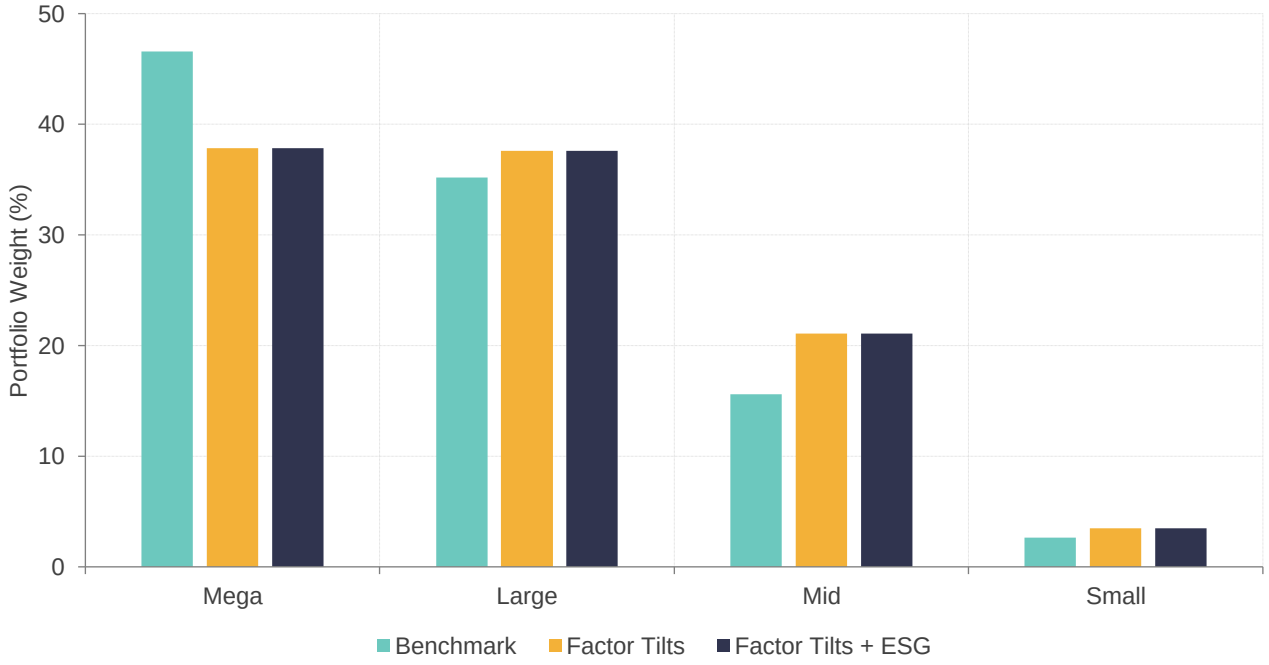
Portfolio Characteristics

The effects of these tilts on portfolio characteristics are illustrated in the following charts. In each of these charts, we compare a portfolio that is market-weighted (labelled *Benchmark*) with a portfolio that tilts towards smaller stocks as well as to our composite Value score (labelled *Factor Tilts*), and then a portfolio that integrates ESG scores with the *Factor Tilt* portfolio (labelled *Factor Tilts + ESG*).[16]

[16] The universe of stocks here is mainly large/mid cap however some companies are shown as small cap as they have drifted in size since the constituents were rebalanced.

In Exhibit 13, we show portfolio weights by Size group. The Benchmark has around 46% of its weight in mega-cap and 15% in mid-cap stocks. The *Factor Tilts* and *Factor Tilts + ESG* portfolios have around 38% in mega-cap and 21% in mid-cap stocks. Hence, after we introduce the ESG tilt, the size tilt is preserved.

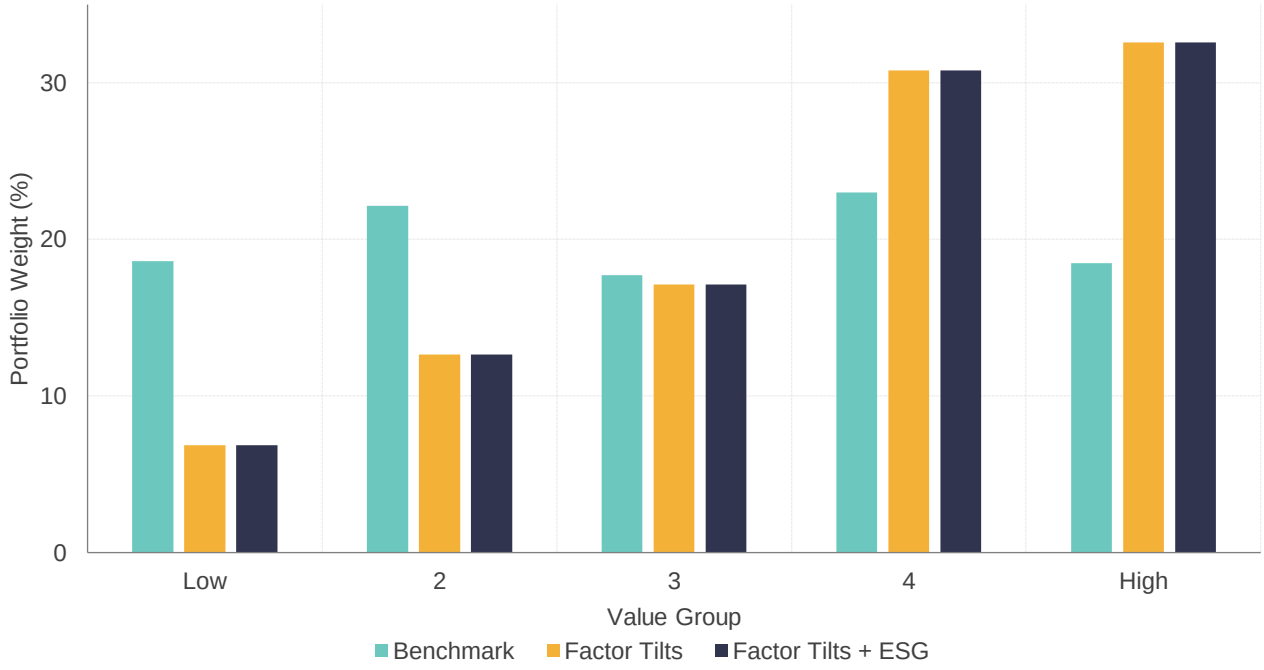
Exhibit 13 Global Weights by Size Group



Source: GSI, Sustainalytics, FactSet.

In Exhibit 14, we show portfolio weights by Value group. The Benchmark has around 18% of its weight in the Low-Value group and around 18% in the High-Value group. Since we underweight Low-Value companies and overweight High-Value companies, the *Factor Tilts* and *Factor Tilts + ESG* portfolios have around 7% in the Low-Value group and 32% in the High-Value group. Once again, after we introduce our ESG tilt, the Value tilt is preserved.

Exhibit 14 Global Weights by Value Group



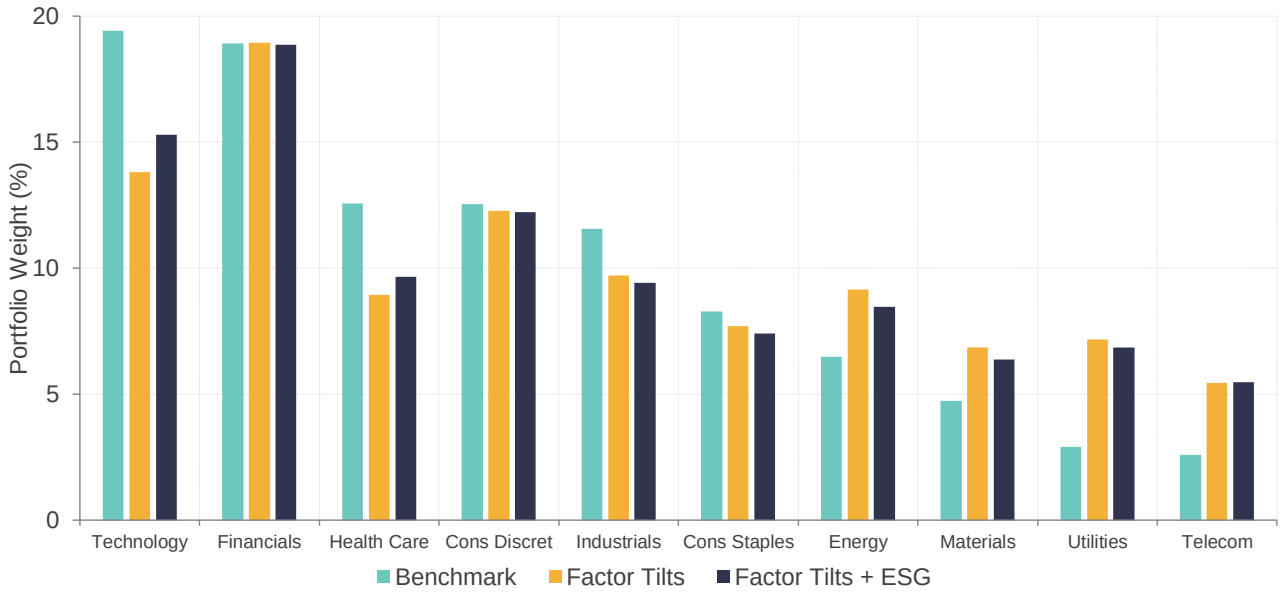
Source: GSI, Sustainalytics, FactSet.

In Exhibit 15, we show portfolio weights by Sector. The *Benchmark* has around 19% of its weight in the Technology sector and around 2% in the Telecommunications sector. We aim to maintain broad sector diversification in our portfolio, and our portfolios are more diversified on a sector level relative to the market-weighted *Benchmark*. The measure of diversification we use is the Herfindahl Index, a standard measure of concentration in economics, which, when applied to sectors, is calculated as the sum of the squared weights allocated to each sector. Concentration is the opposite of diversification, hence the lower the Herfindahl index, the less concentrated (more diversified) the portfolio. The Herfindahl index for an equal-weighted allocation across sectors would be 1/10 or 0.1. If a portfolio were invested in only one sector, then the sector-level Herfindahl would be 1. For the *Benchmark*, *Factor Tilts and Factor Tilts + ESG* portfolios the Herfindahl is 0.133, 0.115 and 0.116 respectively. This means that our *Factor Tilts + ESG* portfolio has a sector level diversification that is about half way between the market-weighted *Benchmark* and an equal-weighted sector portfolio and so is significantly more diversified at the sector level than the *Benchmark*.[17]

There is some alteration in the sector weights after the integration of ESG scores. This is inevitable since, although we do adjust ESG scores for sectors sector weights will nonetheless shift as a result of interactions between ESG scores and the Value scores. It is clear however that the *Factor Tilts + ESG* portfolio is not overly concentrated in any sector and is more broadly diversified by sector than the *Benchmark* portfolio.

[17] For more details on the effect of sector diversification on portfolio risk and return, see Hanke and Quigley 2014.

Exhibit 15 Global Sector Weights



Source: GSI, Sustainalytics, FactSet.

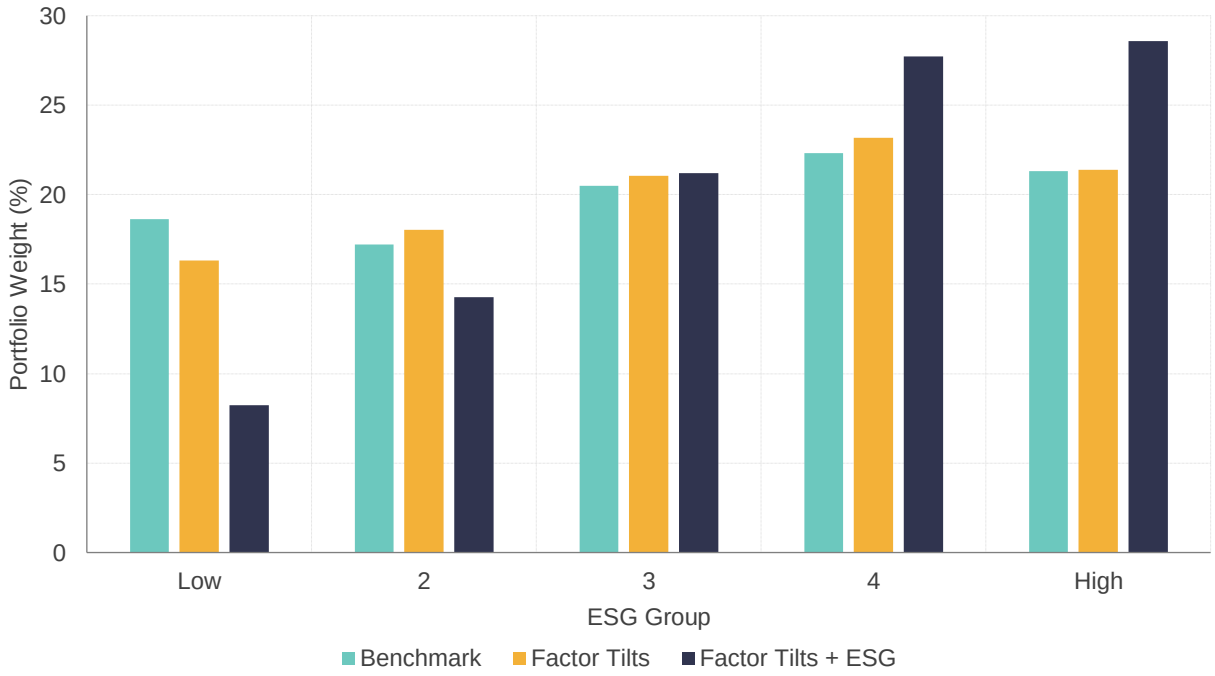
As was pointed out earlier, there is a relationship between raw ESG scores and sectors. If we were to ignore this relationship, we would potentially skew our portfolio more heavily to sectors with higher ESG scores. Instead our policy is to tilt towards companies with higher ESG scores within each sector. Whilst one could choose to more single-mindedly pursue higher ESG scores (and thus a higher ESG portfolio "rating") we believe that this would be at the cost of broad sector diversification, which would be undesirable.

Finally, in Exhibit 16 we show the effect of ESG integration on ESG exposure in the portfolio. The Benchmark has around 18% of its weight in the Low-ESG group and around 22% in the High-ESG group.[18] Since we underweight Low-ESG companies and overweight High-ESG companies, The *Factor Tilts* portfolio has a slight bias away from the lowest ESG group. This is a by-product of the factor-tilting and is partly due to the avoidance of very low profitability stocks which also, on average, have low ESG scores. After tilting to ESG, the *Factor Tilts + ESG* portfolio has around 8% in the Low-ESG group and 28% in the High-ESG group representing a significant, but not extreme, tilt towards higher ESG companies.

Since we control for sector and size effects (as mentioned above) when applying ESG scores, we tilt towards higher ESG stocks within each sector as well within each size group (Mega, Large, Mid and Small). This way we ensure that we tilt towards the "best-in-class" ESG stocks in a balanced way throughout the portfolio, whilst preserving our factor tilts.[19]

[18] Note that we base our ESG groups here on our ESG scores after they have been adjusted for region, sector and size bias. Based on "raw" ESG scores, the Benchmark is more heavily skewed to higher ESG due to the strong positive relation between company size and raw ESG score.
[19] The charts showing this are somewhat detailed and therefore are not shown but are available on request.

Exhibit 16 Global Weights by ESG Group

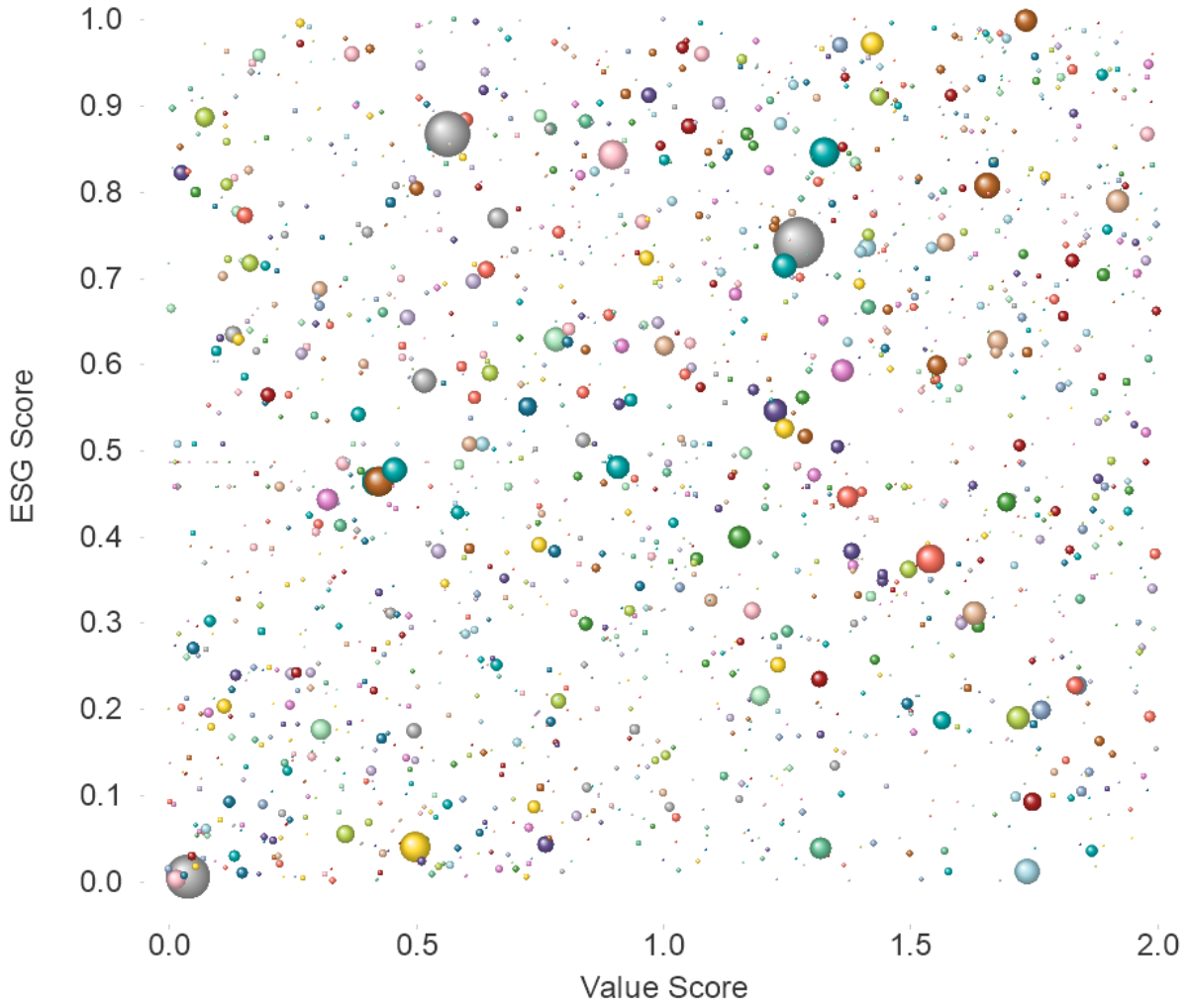


Source: GSI, Sustainalytics, FactSet.

Stock level view

We can also illustrate the impact on our portfolio of integrating ESG scores from a stock level perspective. In the following charts we show scatterplots of portfolio positions for each of the above portfolios, namely the *Benchmark*, *Factor Tilts* and *Factor Tilts + ESG* portfolios. In Exhibit 17, we show our *Benchmark* portfolio positions. The X-axis here is our composite Value score which ranges from 0 to 2. The Y-axis is our adjusted ESG score which is ranked from 0 to 1. Each dot in the chart represents a position in a stock and the size of each dot is proportional to the benchmark weight of each company. For example, the large grey dot in the bottom left corner represents the position in Amazon. Amazon has a low Value score (it trades at a high price relative to its fundamentals) and a low ESG score. Hence its position is close to the bottom-left corner. Another large US stock is Apple which is represented by the large grey dot in the upper-right area of the chart. Apple has a higher Value score and a better ESG score than Amazon.

Exhibit 17 Scatterplot of Company Weights by Value and ESG score – *Benchmark*



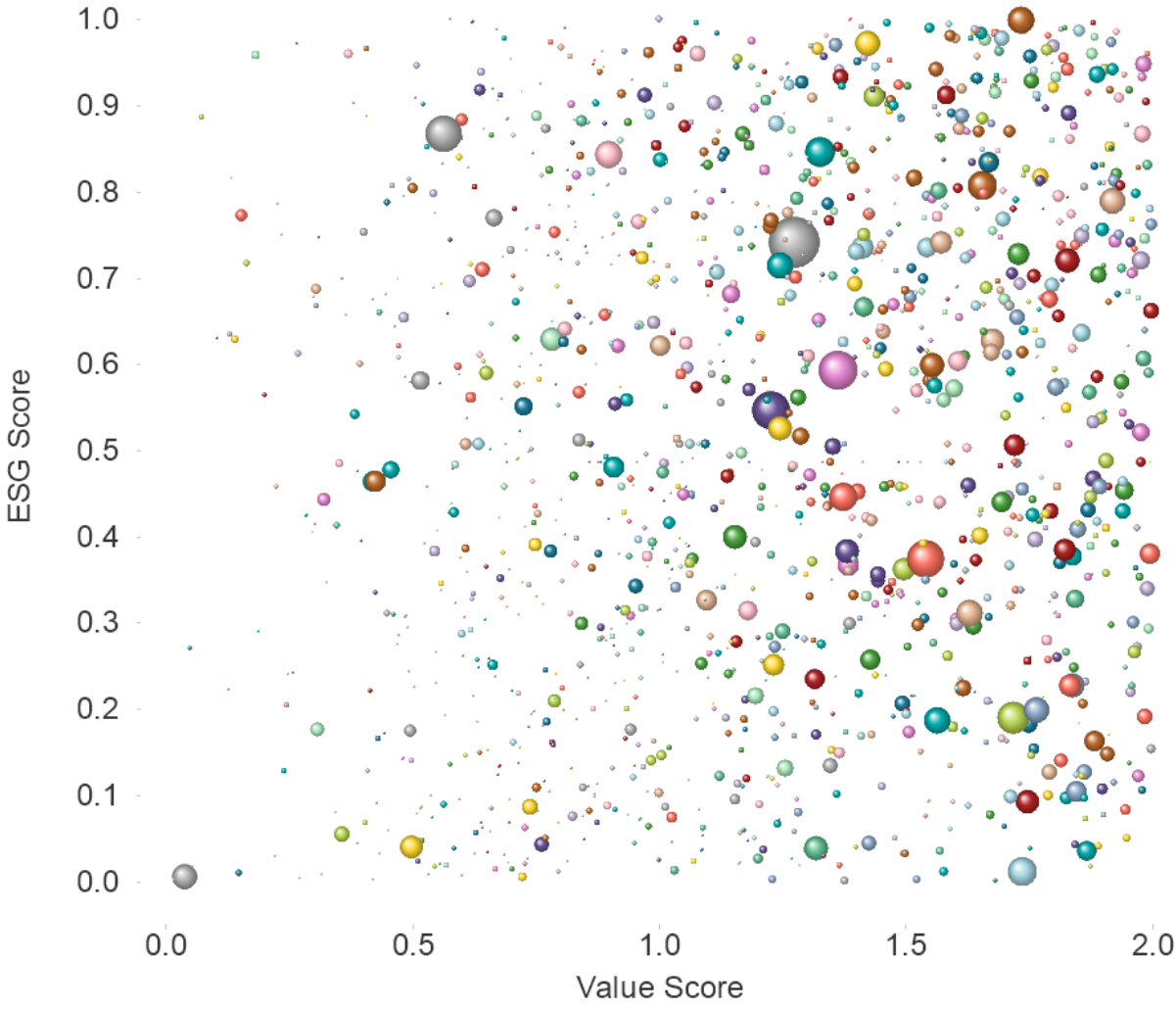
Source: GSI, Sustainalytics, FactSet.

To illustrate the effect of our factor tilts on the portfolio, (before including ESG tilts) we show the positions of the *Factor Tilts* portfolio in Exhibit 18 using the same layout. A key pattern that is evident in the chart is that the positions on the right of the figure, representing the companies with higher Value scores, now have higher portfolio weights - the size of the dots increases. Similarly, companies with lower Value scores (such as Amazon) now have lower weights. While Amazon's weight decreases, it does not go to zero since we don't want to eliminate our exposure to such a large stock in a core global equity strategy. However, some of the smaller stocks with very low Value scores will be eliminated from the portfolio since we are more comfortable excluding them from the portfolio.

As was previously shown, this portfolio also tilts more towards smaller cap stocks and away from very large stocks. This partly explains why Apple's weight does not increase in this portfolio. Another reason for this is that, just as we restrict under-weighting mega-cap stocks

such as Amazon, we also restrict over-weighting mega-cap stocks such as Apple. This point was mentioned earlier in the Factor-based Strategy section.

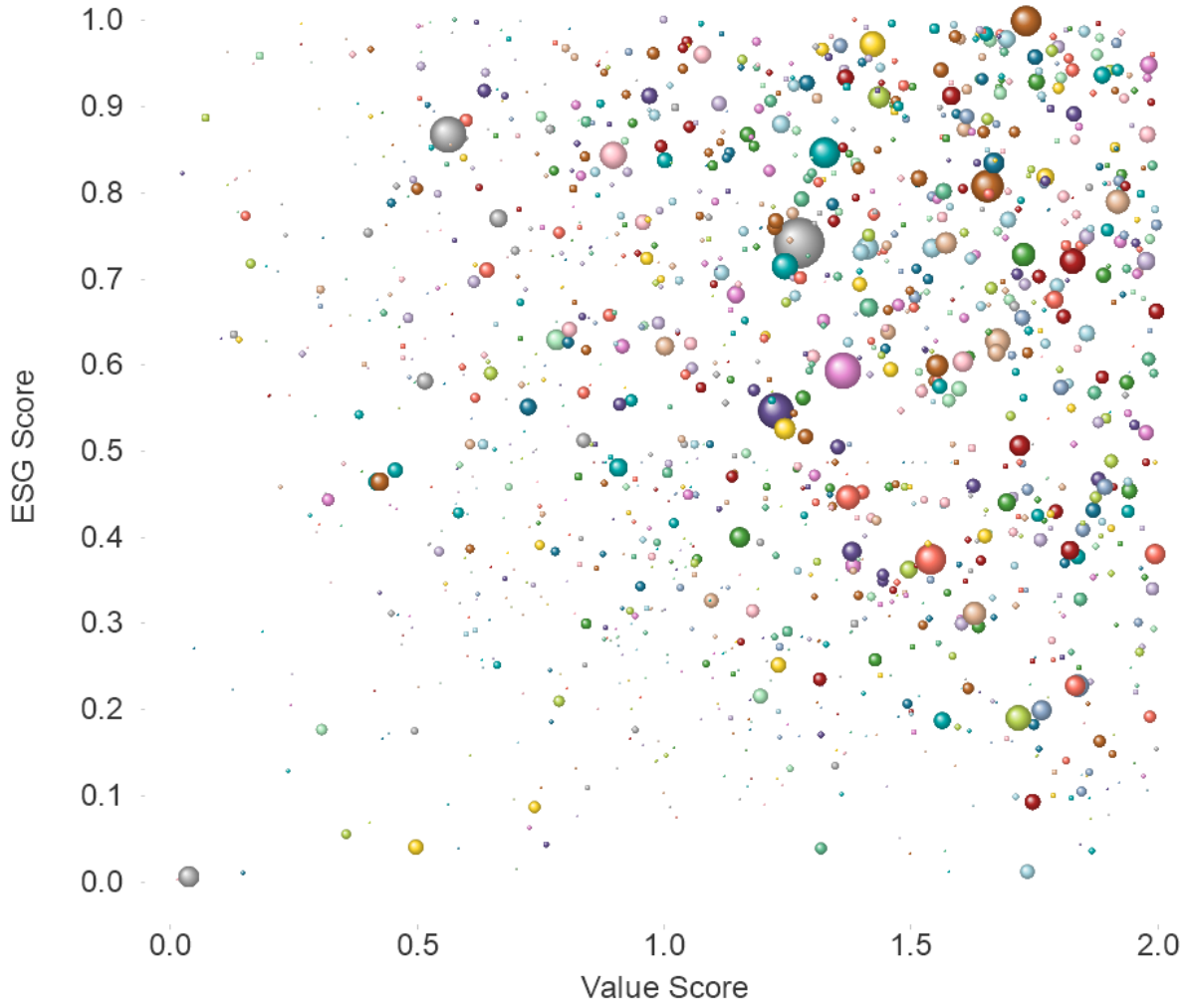
Exhibit 18 Scatterplot of Company Weights by Value and ESG score – *Factor Tilts*



Source: GSI, Sustainalytics, FactSet.

We now show the effect of integrating ESG scores in our portfolio and show the positions of the *Factor Tilts + ESG* portfolio in Exhibit 19. From the pattern of weights in the chart it is evident that we now introduce an additional tilt towards higher ESG scoring companies and away from lower ESG scoring companies. The tilt to the right, towards higher Value companies, has been preserved. As with Value tilting, we limit the degree of over- or under-weighting for mega-cap companies and therefore some companies with low ESG scores will still have positions in the portfolio to limit excessive under-weighting in them. As with our Value tilting approach, however, some of the smaller stocks with very low ESG scores will be eliminated from the portfolio since we are more comfortable excluding them form the portfolio.

Exhibit 19 Scatterplot of Company Weights by Value and ESG score – *Factor Tilts + ESG*



Source: GSI, Sustainalytics, FactSet.

Back-Testing of the Strategy

We now turn to the results of back-testing our approach to integrating ESG scores in a factor-based investment strategy. Our investment universe is based on the S&P Global Developed Markets Large/Mid Cap Index which is not subject to survivorship bias or back-filling. Market data and fundamental data that we use is provided by FactSet, a leading financial data provider. Our ESG data is provided by Sustainalytics.

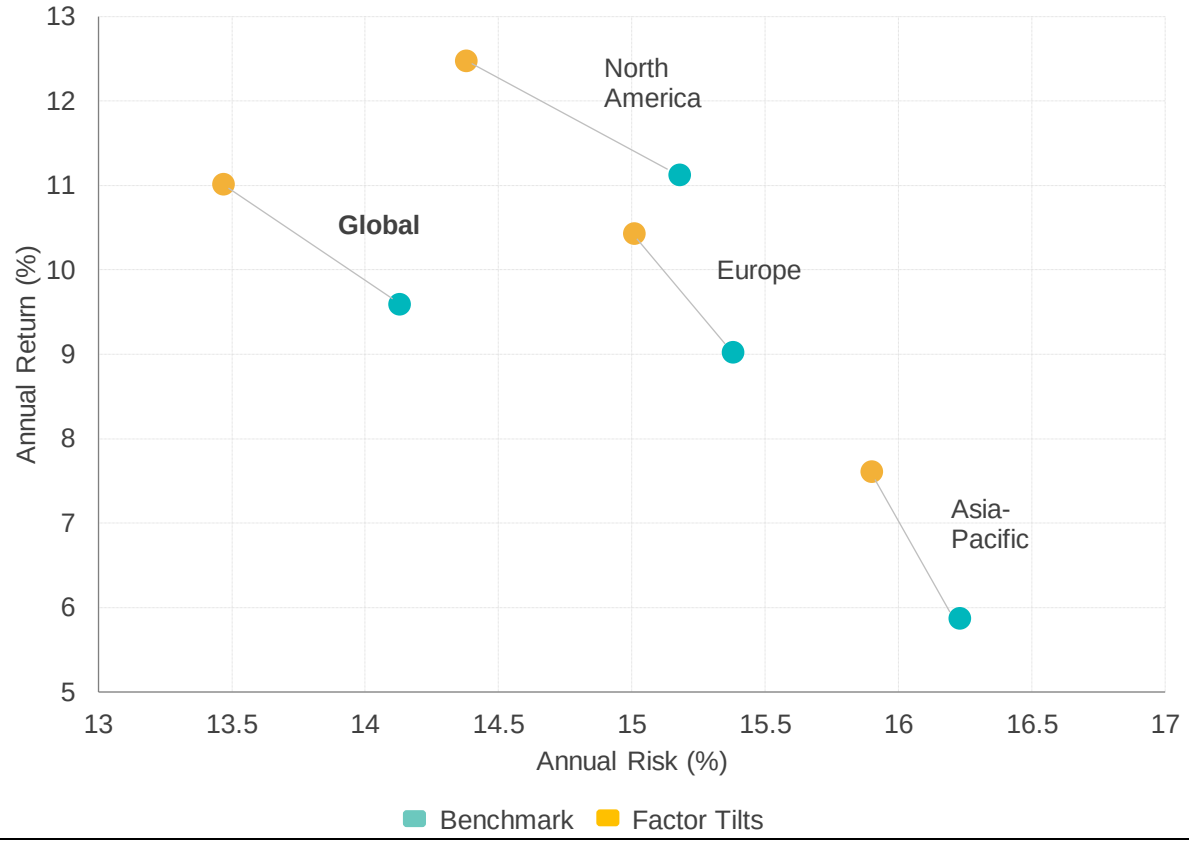
We simulate each of the strategies shown before: *Benchmark* which is market-weighted; *Factor Tilts* which is tilted toward smaller stocks as well as to our composite Value score; and *Factor Tilts + ESG* which integrates ESG scores with our *Factor Tilt* portfolio. Portfolios are rebalanced quarterly. We run two sets of back-tests, one from January 1992 using our Factor Tilts portfolio and one from October 2008 (over the last 10 years). The latter back-test also includes our Factor Tilts + ESG portfolio since ESG data from Sustainalytics is only available

over the last ten years. We include estimated trading costs in our back-tests.[20] However the results are before taxes, management fees and administrative expenses.

Our back-test results are shown below in Exhibit 20. We show annual compound returns (ACR) and annualised standard deviations. All returns shown are in GBP.

Exhibit 20 Back-Test Portfolio Risk and Return

Panel A: Factor Tilts vs. Benchmark (Period: Jan 1992 – Sep 2018)



Source: GSI, Sustainalytics, FactSet, S&P. Based on S&P Global Developed Markets Large/Mid Cap Index constituents 1992-2018; Market and fundamental data provided by FactSet. ESG data provided by Sustainalytics. Returns are before taxes, management fees and administrative expenses, and are after estimated transaction costs (see footnote 20). These results refer to simulated past performance and past performance is not a reliable indicator of future performance.

Exhibit 20 (Panel A) shows that the Factor Tilts portfolio outperformed its market-weighted benchmark in all regions and globally over the last 27+ years. Moreover, all Factor Tilts portfolios have lower risk than the benchmark over this period. This highlights the benefit

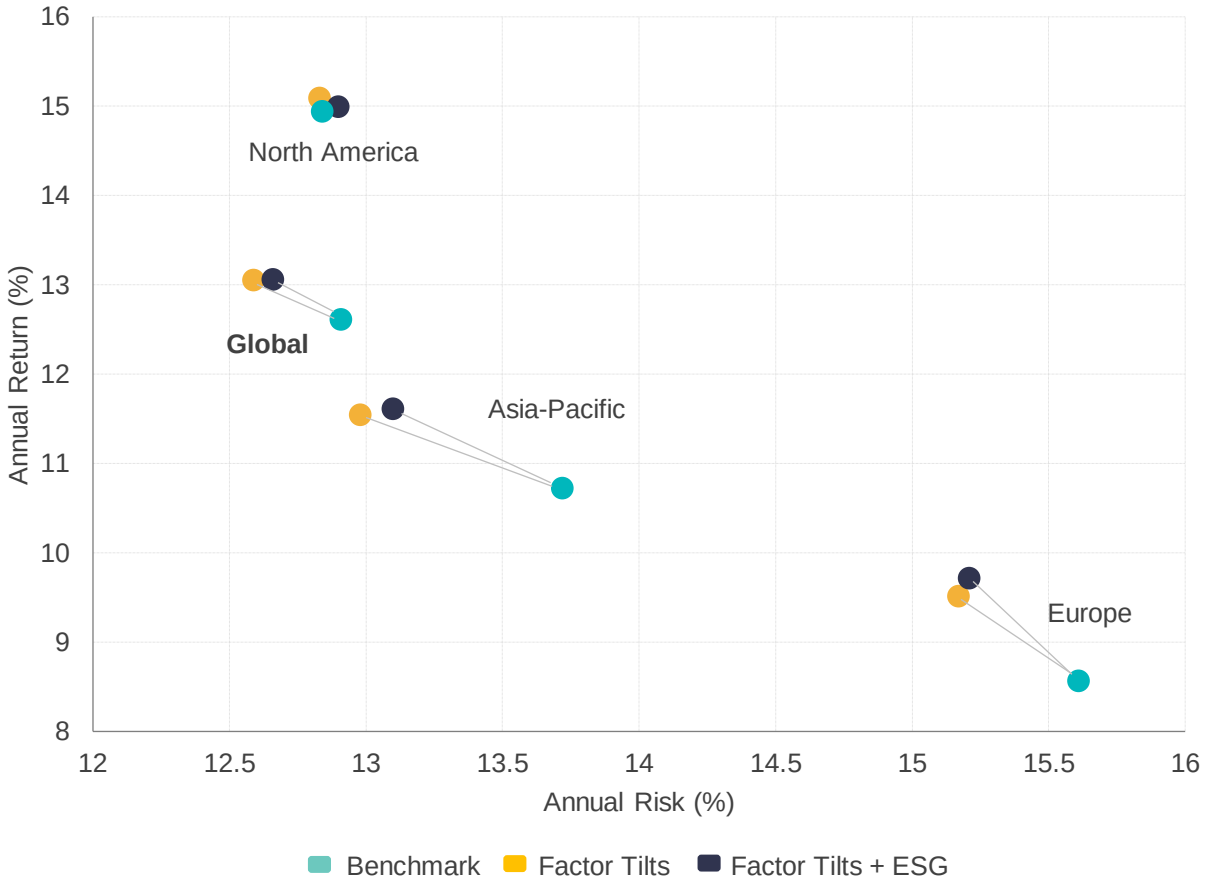
[20] We assume trading commissions of 12bp per trade (plus stamp duty of 50 bp on buys in the UK). Bid-ask spread estimates globally: large cap (top-70% of market cap) = 25 bp, mid cap (next 15% of market cap) = 50 bp, small cap (bottom 15% of market cap) = 75 bp. (Before S&P changed their size break definition in 2008, we used large/mid (top-80% of market cap) = 50bp and small (bottom-20% of market cap) = 75 bp). We assume that we have to pay the full bid-ask spread for a round-trip transaction. We assume that market impact costs are zero.

maintaining sector diversification as well as using a range of metrics to define value and profitability.

Exhibit 20 (Panel B) shows that over the last 10 years the *Factor Tilts* portfolios have continued to outperform the *Benchmark* portfolios, although the outperformance has been small in North America. The Factor Tilts portfolio risk has also continued to be lower than the Benchmark risk in most cases. During this 10-year period, value stocks as measured by the MSCI Developed Markets Value Index underperformed the corresponding broad market index by around 1% a year so the value effect was in fact negative over this period. Notably, both the Factor Tilts and the Factor Tilts + ESG portfolio have almost exactly the same realised return and very similar risk. There is therefore no meaningful impact on returns or risk after we have integrated the ESG scores in the strategy. The main reason for this is because we carefully manage the key dimensions of risk and return in the *Factor Tilts + ESG* portfolio in that we do not alter regional allocation, we maintain sector diversification, and we maintain the same exposure to size and our composite Value score as we would in a strategy that does not include ESG information. We would expect that the key drivers of risk and return are associated with these dimensions, which are well established in the academic and practitioner literature.

Exhibit 20 Back-Test Portfolio Risk and Return

Panel B: Factor Tilts, Factor Tilts + ESG vs. Benchmark (Period: Oct 2008 – Sep 2018)



Source: GSI, Sustainalytics, FactSet, S&P. Based on S&P Global Developed Markets Large/Mid Cap Index constituents 1992-2018; Market and fundamental data provided by FactSet. ESG data provided by Sustainalytics. Returns are before taxes, management fees and administrative expenses, and are after estimated transaction costs (see footnote 20). These results refer to simulated past performance and past performance is not a reliable indicator of future performance.

Summary

The strategy we have set out in this paper, which integrates ESG considerations with a factor-based investment process, is designed to serve as a core investment component for investors seeking to incorporate sustainability into their global investment allocations. We expect our strategy to deliver returns that are commensurate with a factor-based strategy before the integration of ESG information. The risk should also be similar since the key drivers of risk – country, sector, size and other factor exposures – are designed to be the same after the ESG integration as they were before.

The ESG space continues to evolve and the adoption of ESG in investment strategies is now accelerating across the industry. In the future, we expect that it will standard for investors to assume that their managers are incorporating ESG considerations when making their investment allocations. In fact, regulators are likely to require this in the future.

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