



## SRI Integration using Smart Beta

### The BIGGEST SRI challenge

The overwhelming challenge faced by investment managers with an SRI mandate is to determine how best to integrate SRI convictions into an existing portfolio strategy.

### Addressing the SRI challenge

In this research, we provide a methodical framework to analyze a multitude of ESG integration strategies from simple screening to SMART beta portfolios.

### Analyzing ESG integration

We conduct a thorough analysis of negative exclusionary ESG screening in simple as well as optimized portfolios. We also analyze the effects of SRI compliance with risk parity, minimum variance, and maximum diversification portfolios.

### SMART beta may be the SMART choice

We find that ESG integration works best within certain smart beta strategies and provide an in-depth analysis to assess the reasons underlying this outperformance.

Javed Jussa

javed.jussa@db.com

Miguel-A Alvarez

miguel-a.alvarez@db.com

Sheng Wang

sheng.wang@db.com

Yin Luo, CFA

yin.luo@db.com

Zongye Chen

john.chen@db.com

North America: +1 212 250 8983

Europe: +44 20 754 71684

Asia: +852 2203 6990



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Deutsche Bank Securities Inc.

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# A letter to our readers

The dire ramifications of the 2008 global financial crisis forced governments across the world to act quickly and swiftly to stabilize threatening levels of market deterioration and panic. Subsequent to the crisis, most global economies were suffering from high unemployment, crashing housing prices, and negative to stagnant economic growth. The cause of the financial crisis has been debated at length by academics, economists, governments, and policy makers.

While there is still debate about the underlying causes of the crisis, the overwhelming belief is the financial crisis was perpetuated by lack of responsible and righteous investment philosophy. The grave consequences of the financial crisis have forced not only governments; but also, the financial industry to rethink and reevaluate their investment goals and philosophies. As a result, pension funds, beneficiaries, sovereign wealth funds, endowments, asset owners, investment managers, and investment consultants are reconsidering their investment methods and approach.

This viewpoint is being further bolstered not only by the consequences of the financial crisis; but also, by the ramification of global warming (as recently experienced by several local and global economies), corporate governance practices by companies, depleting natural resources, as well as the numerous examples of social inequality and injustices.

As global investment managers rethink their investment goals, they are encouraged to consider the environment, social, and governance ramifications of their investment decisions. However, the overwhelming challenge that investment managers face is how best to integrate these convictions into their portfolio. Can they integrate their convictions by simply screening out so called “sin” companies from their portfolio? What is the impact on portfolio performance and risk from negative exclusionary screens? Is there a better method or framework to integrate their SRI convictions rather than simply excluding companies? What is the impact of SRI integration on tracking error, drawdown, portfolio constraints, transfer coefficient etc? These are not easy questions to answer.

As such, in this report, we take an in-depth look at SRI integration methodologies and strategies. We discuss a multitude of frameworks for optimally integrating SRI into existing portfolio mandates. We also take an in-depth look at how SRI integration affects SMART beta portfolios such as minimum variance, maximum diversification, and risk parity.<sup>1</sup> The results we find may surprise you. Read on and we hope you enjoy the remainder of the report.

Regards,

Yin, Miguel, Javed, John, and Sheng  
**Deutsche Bank North American Quantitative Strategy**

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<sup>1</sup> Note that Maximum Diversification® is registered as a trademark by TOBAM.



# The Evolution and Revolution of SRI

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## What is causing the resurgence of interest in SRI?

Aside from the financial crisis, global warming, and the European debt crisis, the evolution in investment philosophy towards SRI is in part being fueled by the Principles of Responsible Investment (PRI) which were formed in April 2006. The PRI is a United Nations supported initiative consisting of an international network of investors working collectively to put the six principles of responsible investment into practice. PRI essentially provides a set of guidelines and governing principles to integrate ESG principles into the investment process. The six principles are all voluntary and offer a menu of actionable options for incorporating ESG into investment practices across asset classes. The goal is for investors to better understand the implications of ESG issues on the investment process. Asset owners and investment managers are encouraged to become signatories of PRI. Currently there are approximately 1,200 hundreds signatories as part of PRI representing approximately \$34T in assets under management (AUM). The principal category of the signatory is asset owners. The six principles are:

- Principle 1: We will incorporate ESG issues into investment analysis and decision-making processes.
- Principle 2: We will be active owners and incorporate ESG issues into our ownership policies and practices.
- Principle 3: We will seek appropriate disclosure on ESG issues by the entities in which we invest.
- Principle 4: We will promote acceptance and implementation of the Principles within the investment industry.
- Principle 5: We will work together to enhance our effectiveness in implementing the Principles.
- Principle 6: We will each report on our activities and progress towards implementing the Principles.

Note that the principal category of the signatory is asset owners. This has also caused asset owners to encourage their investment managers to better integrate ESG into their investment framework. Asset owners are increasingly requiring that investment managers align their ESG convictions in their investment strategies. ESG integration is also reflected into an asset owner's investment manager appointment. Asset owners are requiring more clarity and transparency on the investment managers' ESG policy. In fact, asset owners are now increasingly requiring a formal, systematic ESG integration strategy from their investment managers. This should be accompanied by annual or even quarterly reporting regarding the extent that investments managers utilize ESG data and practices in their investment strategies. This may of course represent a growth opportunity for investment managers. Next, we discuss the various ESG strategies that investors can employ. We discuss these strategies in more detail later in the report. As an aside, the acronym SRI (Social Responsible Investing) is often coined with ESG (Environment, Social, and Governance). The



areas concerned with SRI can typically be summarized under environment, social, and governance pillars. In this research, we use SRI and ESG interchangeably.

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## The multitude of SRI strategies for investors to choose

There are numerous SRI investment strategies. Below we outline a few broad ESG strategies.

- **Screening:** This is one of the most popular and widely used SRI strategies due to its simplicity. As the name suggest this strategy essentially applies positive inclusionary or and negative exclusionary screens to stocks within an investment universe based on their ESG scores or rankings.
- **Shareholder Resolution:** These are proposals submitted for a vote at the company's annual meeting. Typically, shareholders submit resolutions regarding governance, social responsibility or executive compensation issues. In fact, many asset owners require that their investment managers partake in these resolutions. This is a novel approach to ESG investing by effectively lobbying companies to change certain practices.
- **Impact Investing:** The direct investment and deployment of capital into companies with the intention of making a social, environmental, or governance impact alongside a financial return. Mission based funds, angel funds, micro-finance, philanthropic and community investment funds typically fall into this category.
- **SRI Alpha:** This is a growing trend and involves forming alpha strategies based on ESG ratings and rankings. In a previous publication, we showed in detail how to implement ESG alpha strategies.<sup>2</sup>
- **SRI Integration:** This option has the most mainstream growth potential. SRI integration involves taking an investment manager's current portfolio strategy and enhancing it to become more ESG compliant. ESG screening can be used to accomplish this. However, ESG integration also involves the calculation and analysis on how ESG compliancy has impacted the original portfolio. What are the positive and negative implications of ESG integration? How can we fine tune our level of ESG compliancy to ensure that we don't deviate too much from our benchmark; but at the same time, structure our portfolio with a significant ESG tilt? We will address these and other questions in this research.

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## Defining success

Here we want to briefly touch upon how we define success for the various SRI integration strategies we present in this research. We must keep in mind that the threshold level to assess the performance of ESG strategies may be different from that of traditional quantitative strategies. It may be somewhat unrealistic to expect a significant increase in financial performance when

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<sup>2</sup> For more information, please refer to Jussa, J. et. al 2013, "The Socially Responsible Quant", Deutsche Bank Quantitative Strategy, 24 April 2013.



investing in socially minded companies. However, if financial performance results between ESG strategies are “in line” with other investment strategies, then ESG strategies may be a viable investment opportunity to explore due to their social benefit. By no means are we tempering expectations. We are simply saying that if we had the opportunity to invest in SRI compliant strategies that returned “in-line” performance to noncompliant strategies, then why not consider investing in more socially minded companies. In this publication, we hope to address many of the aforementioned questions and discuss the viewpoints from this hotly debated topic.

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## A topical review of SRI literature

Before proceeding further with the analysis, we want to briefly summarize the academic literature on SRI. As we progressed with this research, we had the opportunity to review and analyze numerous academic journals and articles on SRI. Here we want to highlight a few academic articles that we came across (Figure 1). By no means is this a complete and comprehensive list of SRI research topics and academic studies.



Figure 1: Topical SRI literature review

Paper Title	Author(s)	Key Excerpts and Findings
The Impact of Corporate Social Responsibility on Firm Value: The Role of Customer Awareness	Servaes H. and Tamayo A. [2012]	This paper shows that corporate social responsibility (CSR) and firm value are positively related for firms with high customer awareness, as proxied by advertising expenditures. For firms with low customer awareness, the relation is either negative or insignificant. In addition, we find that the effect of awareness on the value-CSR relation is reversed for firms with a poor prior reputation as corporate citizens.
Is There a Cost to Being Socially Responsible In Investing	Guerard J. B. [1996]	Should an investor expect different returns in socially-screened and unscreened universes? Should a composite model combining traditional value factors with a consensus growth variable produce different returns for socially-screened and unscreened portfolios? We find that returns in socially-screened and unscreened universes do not differ significantly. We also find that a composite model using value and growth variables produces an expected return ranking list that generates equivalent excess returns in socially-screened and unscreened portfolios.
Active Ownership	Dimson E., Karakas O. and Li X. [2013]	We analyze an extensive proprietary database of corporate social responsibility engagements with US public companies over 1999–2009. Engagements address environmental, social, and governance concerns. They are followed by a one-year abnormal return that averages +1.8%, comprising +4.4% for successful and zero for unsuccessful engagements. We document outperformance following environmental/social, as well as governance, engagements.
Does corporate social responsibility affect the cost of capital?	El Ghoul S., Guedhami O., C.Y. Kwok B. C. and R. Mishra D. [2011].	We examine the effect of corporate social responsibility (CSR) on the cost of equity capital for a large sample of U.S. firms. Using several approaches to estimate firms' ex ante cost of equity, we find that firms with better CSR scores exhibit cheaper equity financing. In particular, our findings suggest that investment in improving responsible employee relations, environmental policies, and product strategies contributes substantially to reducing firms' cost of equity.
Monitoring the Monitor: Evaluating CalPERS' Activism	Barber B. [2006]	Many public pension funds engage in institutional activism. These funds use the power of their pooled ownership of publicly traded stocks to affect changes in the corporations they own. I review the theory and empirical evidence underlying the motivation for institutional activism. In general, I argue that institutional activism should be limited shareholder activism where there is strong theoretical and empirical evidence indicating the proposed reforms will increase shareholder value.
Corporate Environmental Management and Credit Risk	Bauer R. and Hann D. [2010].	This study analyzes environmental management and its implications for bond investors. Poor environmental practices influence the credit standing of borrowing firms through the legal, reputational, and regulatory risks associated with environmental incidents. Our findings suggest that firms with environmental concerns pay a premium on their cost of debt financing and are assigned lower credit ratings. In contrast, firms with proactive environmental engagement benefit from a lower cost of debt financing. The results are robust to numerous controls for company and bond specific characteristics, alternative model specifications, and industry membership.
The Economics and Politics of Corporate Social Performance	Baron D. P., Harjoto M. A. and Jo H. [2009]	This paper estimates a three-equation structural model based on a theory that relates corporate financial performance (CFP), corporate social performance (CSP), and social pressure. CFP is found to be independent of CSP and decreasing in social pressure, and CSP is independent of CFP and increasing in social pressure. Social pressure is increasing in CSP and decreasing in CFP, which is consistent with social pressure being directed to soft targets.
Does the Stock Market Fully Value Intangibles? Employee Satisfaction and Equity Prices	Edmans A. [2010]	This paper analyzes the relationship between employee satisfaction and long-run stock returns. A value-weighted portfolio of the 100 Best Companies to Work For in America earned an annual four-factor alpha of 3.5% from 1984–2009, and 2.1% above industry benchmarks. The results are robust to controls for firm characteristics, different weighting methodologies and the removal of outliers. The Best Companies also exhibited significantly more positive earnings surprises and announcement returns.
The Economic Value of Corporate Eco-Efficiency	Guenster N., Derwall J., Bauer R. and Koedijk K. [2006]	This study adds new insights to the long-running corporate environmental-financial performance debate by focusing on the concept of eco-efficiency. Using a new database of eco-efficiency ratings, we analyze the relation between eco-efficiency and financial performance from 1997 to 2004. We report that eco-efficiency relates positively to operating performance and market value. Moreover, our results suggest that the market's valuation of environmental performance has been time variant, which may indicate that the market incorporates environmental information with a drift.
International Evidence on Ethical Mutual Fund Performance and Investment Style	Bauer R., Koedijk K. and Otten R. [2002]	Using an international database containing 103 German, UK and US ethical mutual funds we review and extend previous research on ethical mutual fund performance. By applying a multi-factor Carhart (1997) model we solve the benchmark problem most prior ethical studies suffered from. After controlling for investment style, we find little evidence of significant differences in risk-adjusted returns between ethical and conventional funds for the 1990–2001 period.
Pure Profit: The Financial Implications Of Environmental Performance	Repetto R. and Austin D. [2000]	This report demonstrates how environmental issues can successfully be integrated into financial analysis. It explains a newly developed methodology derived from fundamental principles of financial analysis and demonstrates the approach by applying it empirically to companies in the U.S. pulp and paper industry. This tool provides a way to relate a firm's environmental performance decisions to its value and risk to shareholders.

Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy



# Reviewing the SRI Dataset

## The ESG Dataset

Before delving into the details of systematic SRI integration strategies, we provide a brief refresher for our readers on the ESG dataset we use in our analysis. For this study we employ the MSCI ESG Research dataset. MSCI scores are designed to assist investment managers with the screening and analysis of companies based on sustainability factors as opposed to conventional financial metrics. MSCI ESG scores attempt to gauge a company's impact on environmental, social, and governance pillars. MSCI provides overall ESG industry adjusted scores for companies that are predominantly apart of the MSCI World Index with data commencing from 1999 onwards. In addition, MSCI provides more granular scores and weights for each sustainability pillar: Environmental, Social, and Governance.

Figure 2 shows a snapshot of the MSCI ESG score for 3M Company. MSCI provides an overall ESG numeric and letter score. The overall score is based on a scale of 0 (i.e. CCC) to 10 (i.e. AAA) where the highest ranked companies receive a rating of 10 and lowest ranked companies receive a rating of 0. The overall score is industry adjusted and compares how well a company ranks among its industry peers in terms of ESG criteria. The overall ESG score is derived from the underlying ESG pillars (i.e. Environmental, Social, and Governance). Each underlying ESG pillar is given a score and a weight.

Figure 2: MSCI ESG rating for 3M Company as of September 25 2012

Company Information	Latest Company ISIN:	US88579Y1010
	Company Ticker:	MMM
	Company Name:	3M Company
	Company Industry:	Industrial Conglomerates
	Rating Date:	September 25th, 2012
Overall Score	Letter Rating	AAA
	Final Industry Adjusted Score	9.8
E	Environmental Pillar Score	8.2
	Environmental Pillar Weight	59.8%
S	Social Pillar Score	2.4
	Social Pillar Weight	17.6%
G	Governance Pillar Score	8.7
	Governance Pillar Weight	22.6%

Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

ESG scores are typically provided on a yearly basis when all companies in an industry are reviewed. However, on an exceptional basis, a company's rating may be reviewed and updated between annual updates. Such a mid-cycle review can be precipitated based on several reasons including a severe financial impact faced by a company due to an extraordinary ESG event.

## A snapshot of the dataset

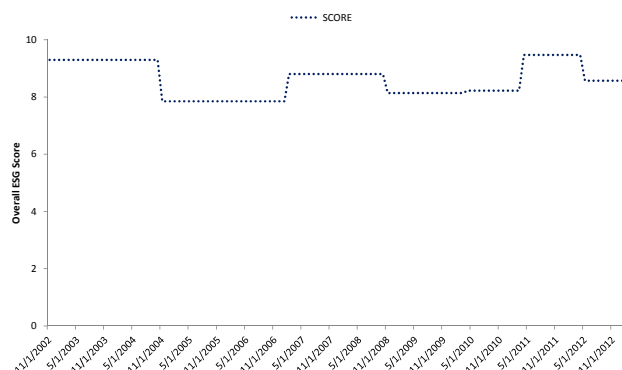
Some of our readers may be unfamiliar with ESG datasets. To better familiarize our readers, here we show a few company specific examples of the ESG dataset. Figure 3 and Figure 4 below shows the overall ESG score for IBM and





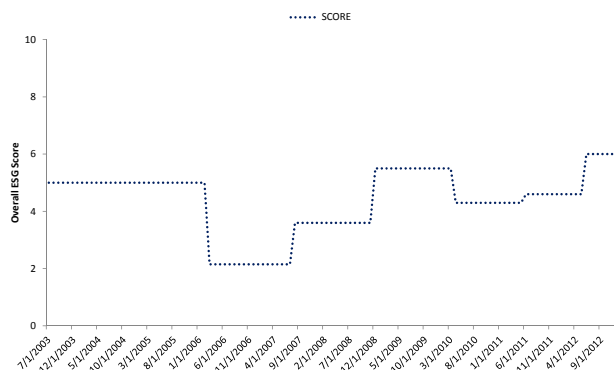
FIAT respectively. Recall that companies are assigned an overall ESG score between 0 and 10. As shown in the figure, IBM boasts a strong ESG rating. In addition to the overall score, each company is also assigned an ESG pillar score (between 0 and 10) and weight (between 0% and 100%).

Figure 3: IBM overall ESG score



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

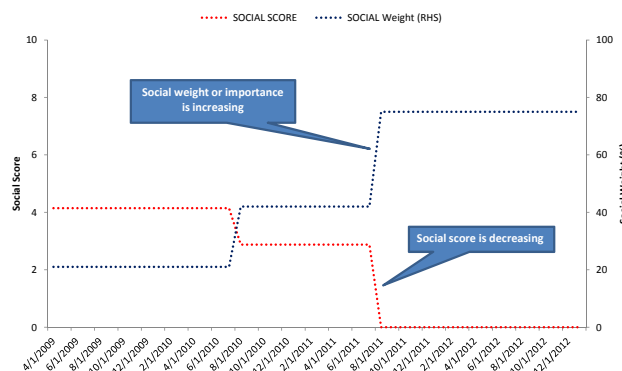
Figure 4: FIAT overall ESG score



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

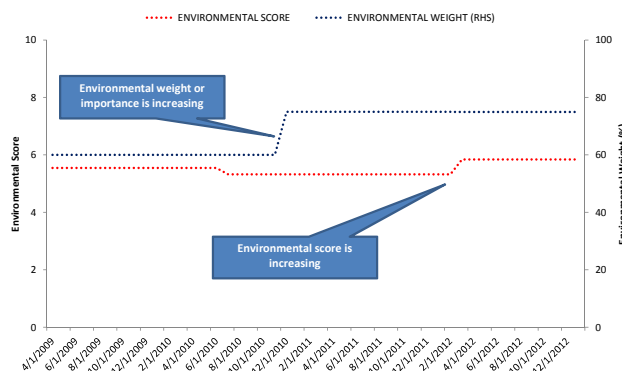
Figure 5 shows the time series social score and weight for Phillip Morris. Although, the social weight or importance has been increasing for Phillip Morris, this is underpinned by a steadily declining social score. Lastly, we look at the environmental pillar rating of Exxon Mobil (Figure 6). The environmental score for Exxon Mobil has been steady to slightly rising. Similarly, the environment weight or importance for Exxon Mobil has also been on the rise.

Figure 5: Phillip Morris Social score and weight



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 6: Exxon Mobil Environmental score and weight



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

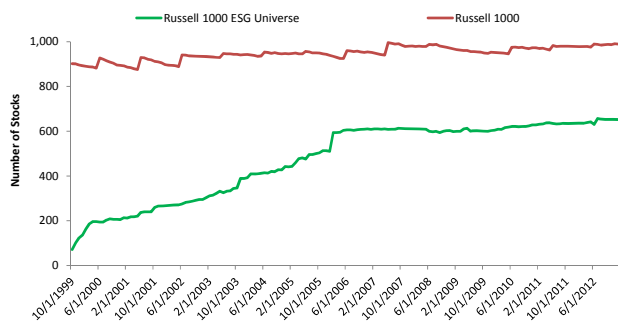
## The ESG coverage is expanding

Adequate stock coverage and history is important when considering a new dataset. It's even more important when analyzing ESG data providers. This is because mainstream ESG integration is fairly new and historical SRI data tends to be sparse and difficult to obtain. Figure 7 and Figure 8 show the time series coverage of the ESG universe for the US and Global markets. This represents the coverage of the overall ESG score and letter rating. The coverage is fairly reasonable when compared to the Russell 1000 and MSCI Global index constituents. For the US market, the ESG universe grows from approximately



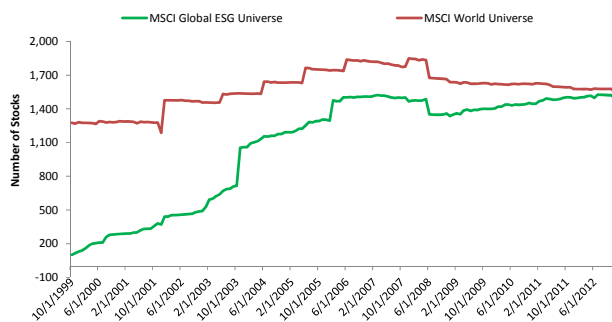
200 stocks in 2001 to over 650 stocks currently. Additionally, the coverage of the global ESG universe closely aligns with the MSCI World universe in more recent years. More recently, MSCI has expanded their dataset to include more companies and countries including emerging markets.

Figure 7: Coverage of ESG Universe in the United States



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

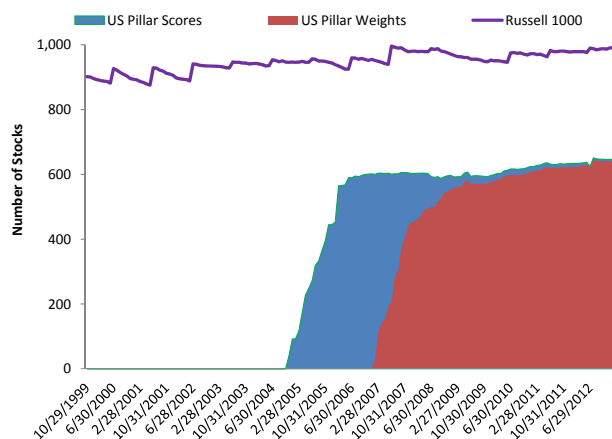
Figure 8: Coverage of ESG Universe Globally



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

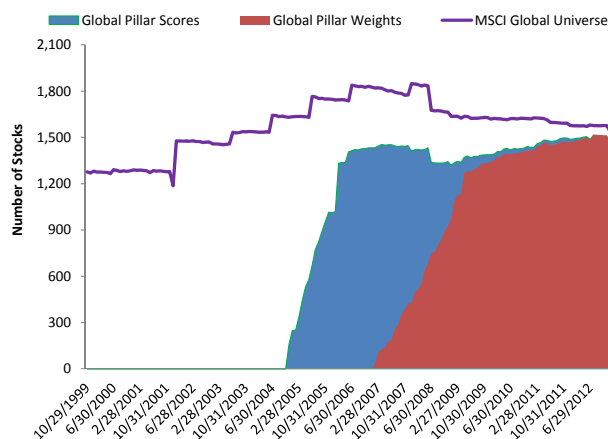
The coverage for the individual ESG pillar scores and weights (Figure 9 and Figure 10) commences in 2004 and 2007 respectively, for both the US and Global universes. The overall letter and rating scores, individual pillar scores, and pillar weights are all available collectively from 2007 onwards.

Figure 9: Coverage of US ESG pillar scores & weights



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 10: Coverage of Global ESG pillar scores & weights



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

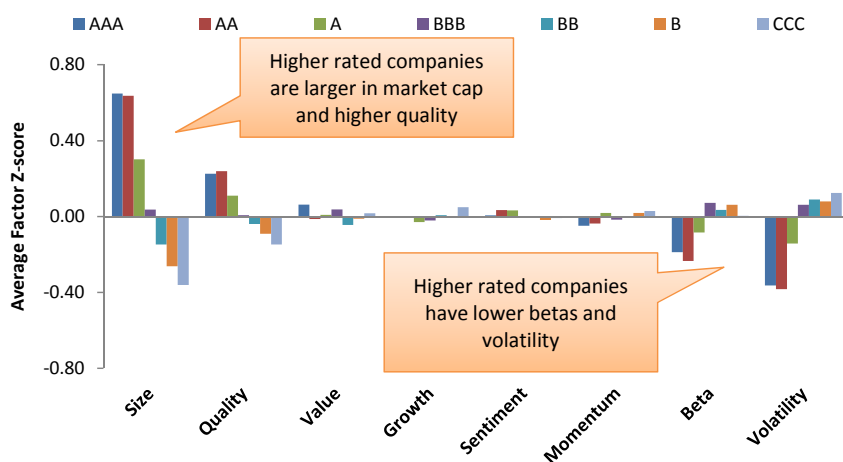
## The makeup of ESG compliant and noncompliant companies

Another analysis to further understand the makeup of the ESG scores is to calculate the factor exposure of various ESG letter ratings. The goal is to better understand what type of fundamental characteristics highly or poorly ESG rated companies reflect. To do this, we start by compiling a good blend of factors. In particular, we look at size, quality, value, growth, sentiment, momentum, beta, and volatility. We calculate the average score for each factor within each ESG letter rating. Figure 11 shows the average factor score or



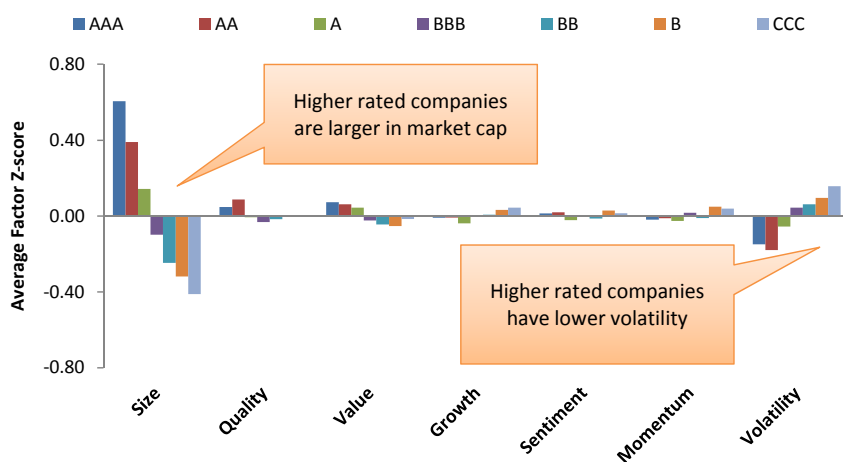
exposure for each ESG letter rating for US companies. The results confirm our intuition and show that in general higher ESG rated companies are larger in market cap, higher in quality, lower in beta, and lower in volatility. We applied a similar analysis for Global companies and found similar results (Figure 12). In summary, higher ESG rated companies tend to be high quality companies. Interestingly, the exposures to other factors (i.e. value, growth, momentum, and sentiment) are fairly modest. This suggests that ESG ratings are derived from an independent source of information. After briefly reviewing the dataset, we are now well positioned to evaluate various ESG screening and integration techniques.

Figure 11: Factor exposure for US companies



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 12: Factor exposure for Global companies



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy



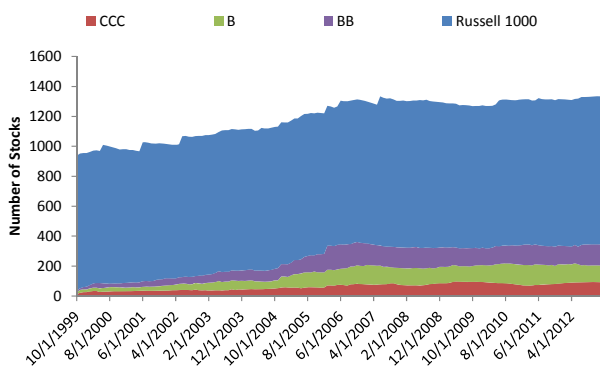
# Simple Screening

## ESG screening shrinks coverage

Let's start off with the simplest SRI strategy: ESG screening. This strategy is typically based on negative exclusionary screening where an investment manager removes poorly ESG ranked stocks from their investment universe. ESG screening can also incorporate a positive inclusionary strategy where an investment manager only includes highly rated ESG companies in their stock selection universe. Here we focus on the efficacy of negative exclusionary screens.

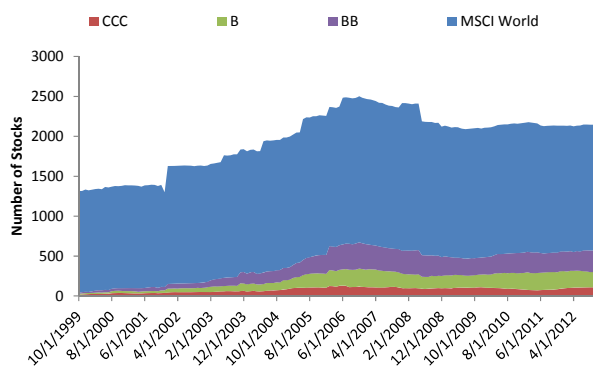
Negative exclusionary screens undoubtedly reduce an investment manager's universe. The key questions that need to be addressed are by how much is the investment universe reduced and what is the impact on portfolio performance as a result of this reduction. Let's start by tackling the first question. Figure 13 and Figure 14 show the time series coverage of the Russell 1000 and MSCI World index universe. Additionally, the figures show the number of CCC, B, and BB rated companies (i.e. low rated companies).

Figure 13: US coverage by overall ESG letter rating



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 14: Global coverage by overall ESG letter rating

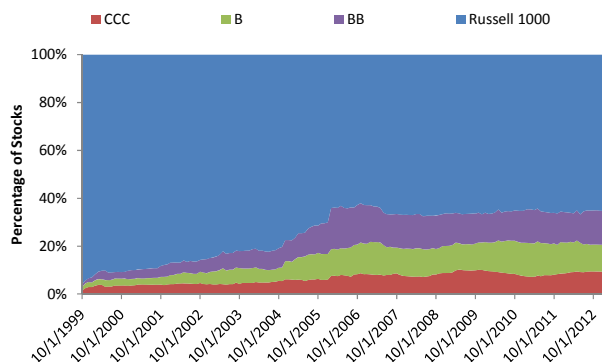


Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 15 and Figure 16 give a better sense of the percentage of stocks that can be typically excluded from an investment manager's universe. Simply removing CCC rated stocks will likely reduce the investment universe by approximately 10%. Removing CCC and B rated stocks can potentially reduce the investment universe by 20%. Finally, removing CCC, B, and BB rated stocks could reduce the investment universe by 30%. This of course can have significant implications for an investor's portfolio.

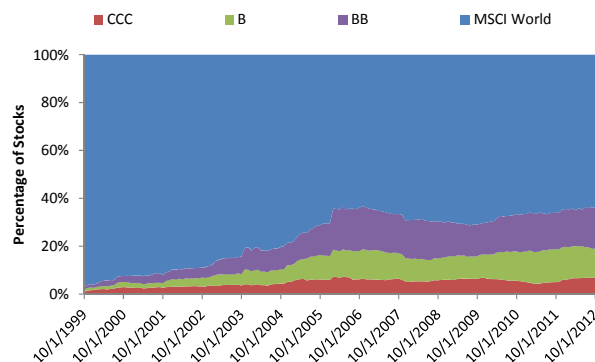


Figure 15: Percentage of US stocks by overall ESG letter rating



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 16: Percentage of Global stocks by overall ESG letter rating



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Keeping this in mind, let's forge ahead to analyze the performance impact of removing these poorly rated ESG companies from common portfolio strategies.

## But screening's impact on performance is fairly benign

We analyze five mainstream quantitative portfolio strategies: value, momentum, sentiment, growth, and quality.<sup>3</sup> These portfolio strategies are long/short, equally weighted, and unoptimized. They are formed by taking a long (short) position in the top (bottom) decile of stocks ranked by the style factor. The backtesting period is from 2000 to 2013, monthly rebalanced. We test these portfolio strategies within two universes: Russell 1000 and MSCI World. Our ESG screening analysis framework is fairly simple.

The first round of analysis involves backtesting these five quantitative portfolio strategies without excluding any stocks (i.e. utilizing the entire investment universe). In the next round, we backtest the same five quantitative portfolios, but this time, we exclude CCC rated stocks from the investment universe. Next, we backtest the same five quantitative portfolios but this time, we exclude CCC and B rated stocks from the investment universe. Lastly, we conduct the backtesting again after excluding CCC, B, and BBB rated stocks. Essentially, we are testing whether the factor premia are robust to ESG screening. Note that all results in this section are reported pre-cost.

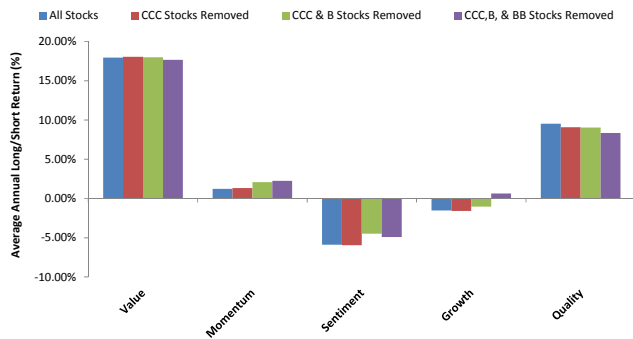
Figure 17 and Figure 18 show the average long/short annual return of each of the five quantitative strategies using the screening technique described above. In this analysis, the overall factor performance is less important. What we want to test here is the incremental impact on factor performance as a result of ESG/SRI exclusionary screening. Interestingly, no visible pattern emerges when applying these ESG screening techniques. In fact, some portfolios perform slightly better or worse depending on the ESG screen applied. Albeit there are several academic studies stipulating that ESG screening limits your investment universe and thereby should hinder performance, in theory. Our findings show that the impact of ESG screening on portfolio performance is fairly neutral to

<sup>3</sup> Most fundamental based investment portfolios are correlated to these 5 strategies.



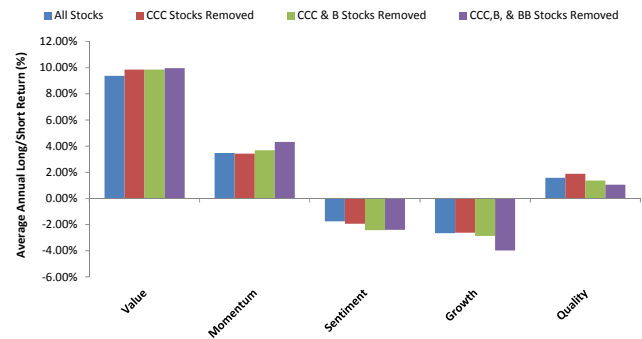
minimal, in practice. All else equal, this means that investment managers can potentially apply ESG screens to common investment strategies without incurring a significant impact on performance.

Figure 17: Average long/short return for ESG screening in the Russell 1000



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

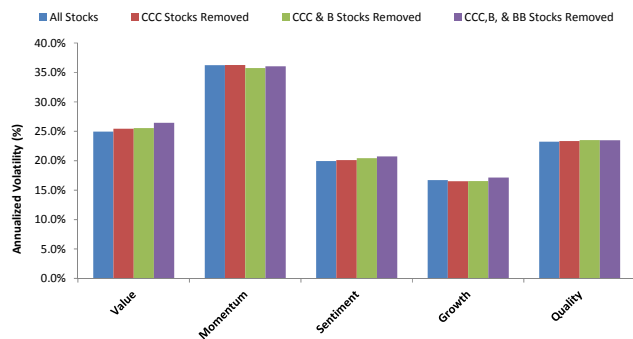
Figure 18: Average long/short return for ESG screening in the MSCI World



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

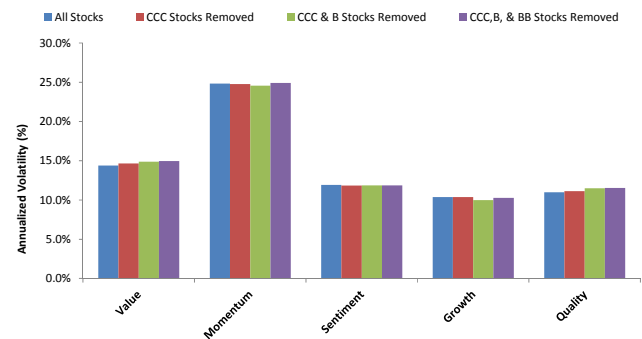
Next we look at the impact of ESG screening on portfolio volatility. Figure 19 and Figure 20 show the portfolio volatility for the various quantitative strategies we backtested. The same indiscernible pattern emerges. Certain portfolios have a slightly higher or lower volatility depending on the ESG screen applied. But the point is that portfolio volatility is not significantly impacted.

Figure 19: Portfolio volatility for ESG screening in the Russell 1000



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 20: Portfolio volatility for ESG screening in the MSCI World

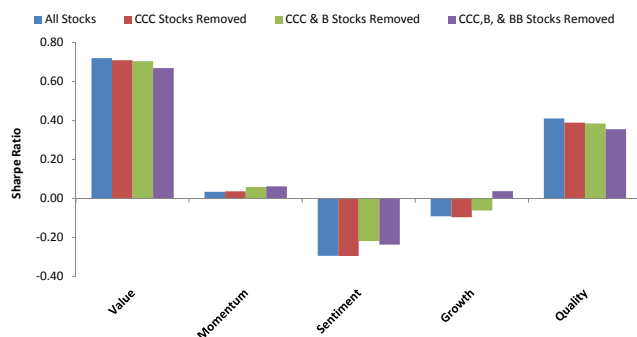


Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Ultimately, we must analyze the interaction and tradeoff between risk and return. Analyzing the Sharpe ratio (Figure 21 and Figure 22) we again see no significant impact as a result of ESG screening.

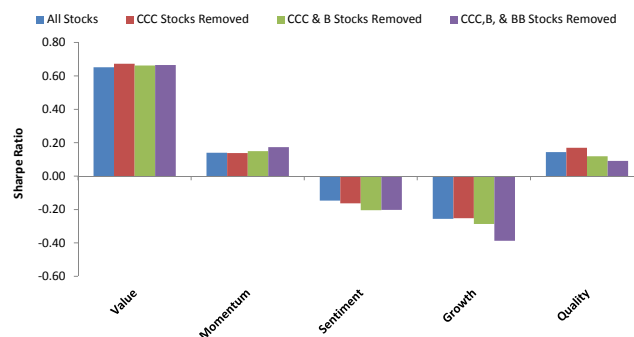


Figure 21: Sharpe ratio for ESG screening in the Russell 1000



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

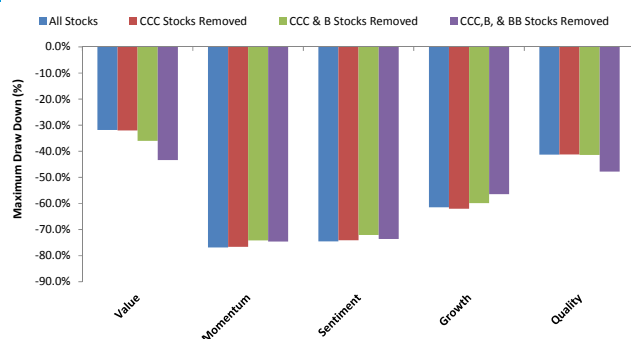
Figure 22: Sharpe ratio for ESG screening in the MSCI World



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

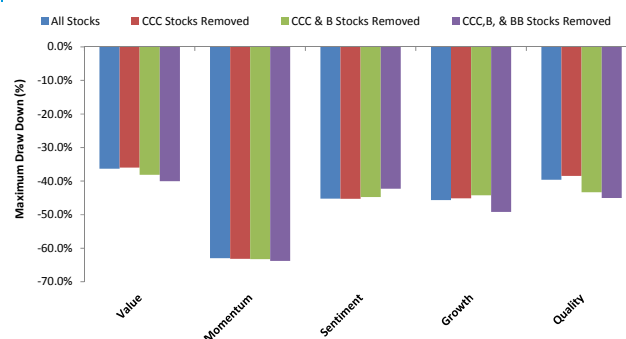
Lastly, we analyze the drawdown impact on ESG screening (Figure 23 and Figure 24). In consistent fashion with prior results, we observe no significant impact on the maximum drawdown resulting from ESG screening. In summary, our analysis suggests that investors can potentially remove poorly rated companies from their investments universe and not incur a significant impact on long/short portfolio performance and risk. Next, we analyze the performance results of integrating SRI into long only, mean variance optimized portfolios.

Figure 23: Maximum drawdown for ESG screening in the Russell 1000



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 24: Maximum drawdown for ESG screening in the MSCI World



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy



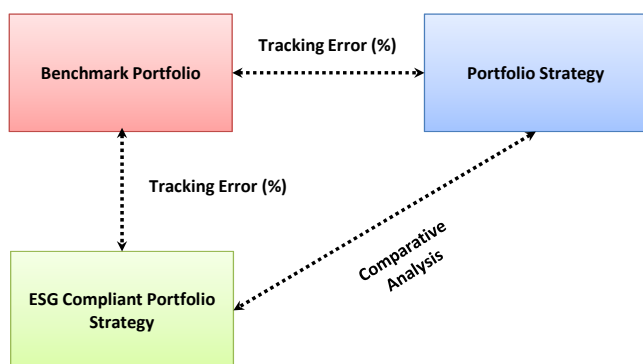
# Optimal SRI Integration

## A framework for ESG integration

In the previous section, we showed that simple systematic screening of poorly rated ESG companies does not significantly impact portfolio performance and risk. One of the drawbacks of a simple SRI exclusionary screen is that it does not take into account more practical portfolio implementation considerations such as turnover and transactions costs. In this section, we introduce an ESG integration framework that addresses this issue. We assess the impact of SRI integration on various optimized portfolio strategies within the boundaries of typical institutional constraints. This will allow for a more realistic and practical assessment of the impact of SRI integration.

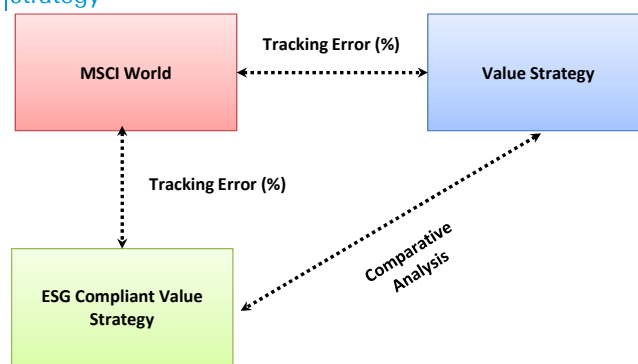
Figure 25 illustrates our ESG integration framework. Initially we evaluate the performance of an optimized, long only, benchmarked portfolio strategy within the entire stock universe. We then test the performance of an optimized, long only benchmarked portfolio strategy within an ESG compliant universe. Finally, we compare the performance of both strategies to gauge the impact of the SRI integration. Both portfolios utilize the same institutional constraints so that they can be fairly compared. Figure 26 shows an example of applying this SRI integration framework to a value strategy.

Figure 25: ESG integration framework



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 26: Example of ESG integration with a value strategy



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

We apply our SRI integration framework to five common portfolio strategies (i.e. value, sentiment, growth, momentum, and quality) and analyze the performance results. Our benchmark universe is MSCI World. To form our ESG compliant universe, we exclude CCC, B, and BB rated stocks. We utilize the global Axioma risk models as well as the Axioma optimizer. Our backtesting period is from 2003 to 2013, monthly rebalanced. We apply the following institutional constraints to all of our portfolios:

- Long only.
- 20bps transaction cost per trade.





- Maximum & minimum active asset weight differential of 2% and -2% respectively.
- Maximum & minimum active beta differential of 2% and -2% respectively.
- Maximum & minimum active sector weight differential of 2% and -2% respectively.
- Target tracking error is 5%.
- Two way turnover constraint of 30% per month.

---

## A quick refresher

Before looking at the performance results, we briefly review mean variance optimization. Mean Variance (MV) simply attempts to weight the underlying portfolios to gain the maximum expected return for minimum risk.<sup>4</sup> This can be implemented via an optimization problem based on the following equation:

$$\arg \max_w w' \hat{r} - \lambda (w' \Sigma w)$$

where,  $\hat{r}$  is the vector of expected returns for each style factor (i.e. value, growth, momentum etc.) and  $\Sigma$  is their covariance matrix. The above equation is subject to the constraint that all the weights in the portfolio are non-negative and sum to 100%. Note that MV optimization requires a specific model of expected returns unlike some of the other techniques we will study later on in this report. Next, we review the performance results of applying SRI integration within an MV framework.

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## Optimization results

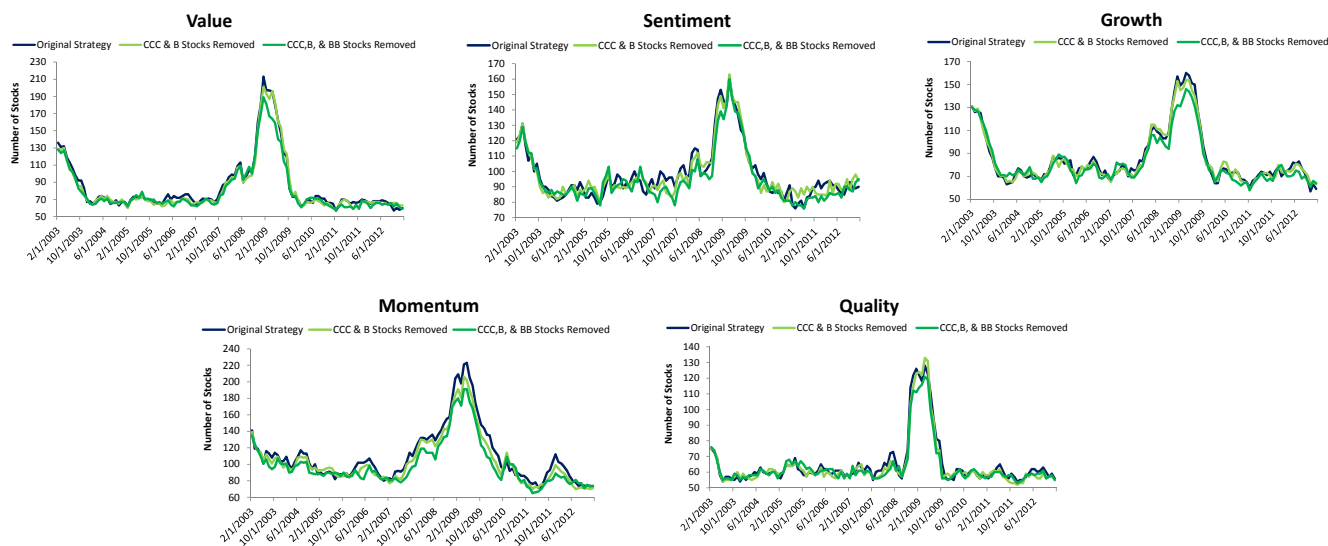
Let's start off by comparing the time series coverage of the optimized portfolios to see if there is any impact as a result of the SRI exclusions. Figure 27 compares the time series coverage of the final optimized portfolios. As shown, the coverage difference is effectively negligible in the final optimized portfolios when applying SRI exclusions. The coverage is in fact, slightly smaller for most ESG compliant portfolios. We are cautious not to interpret too much into this finding. However, it does suggest that the optimizer can obtain an optimal portfolio within the boundaries of the constraints using fewer stocks within an ESG compliant universe. Perhaps an ESG compliant universe is composed of good quality stocks allowing the optimizers to diversify risk by utilizing a smaller subset of stocks.

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<sup>4</sup> For more information on Mean Variance optimization, please see Luo et al. [2010].



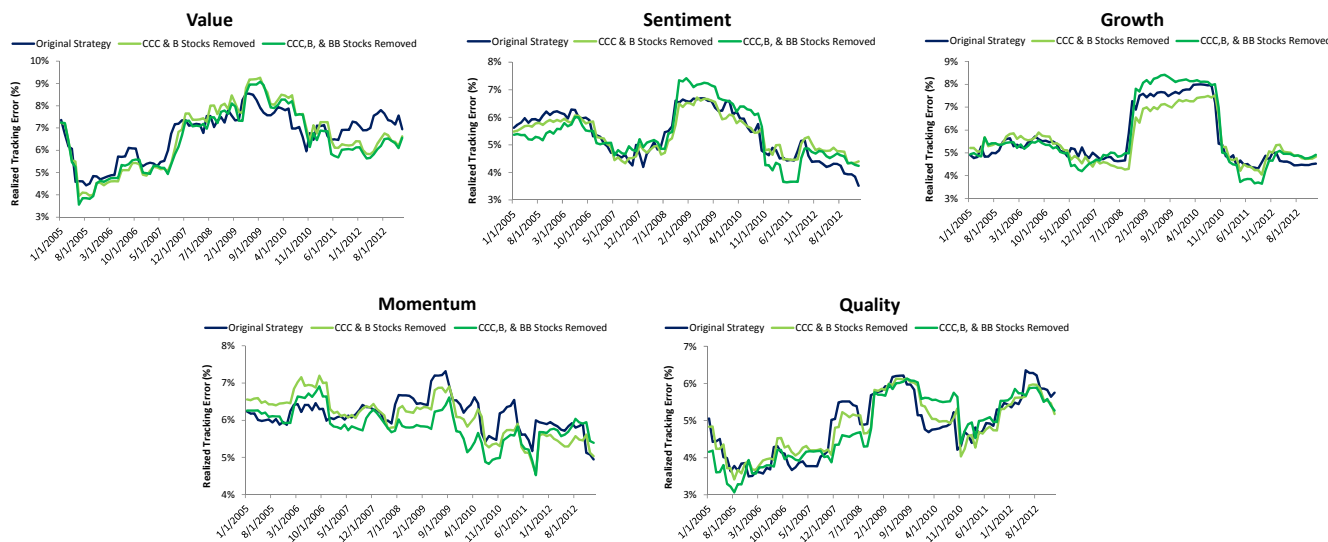
Figure 27: Coverage impact for various optimized portfolios



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Next, we look at the impact on tracking error as a result of the SRI exclusions. Recall the target tracking error was set to 5%. Do the SRI exclusions have any significant positive or negative impact on the portfolio tracking error? Figure 28 compares the time series tracking error of all the optimized portfolios. The results are fairly encouraging as we see no discernible systematic effect between SRI exclusions and portfolio tracking error.

Figure 28: Comparing tracking error for various optimized portfolios



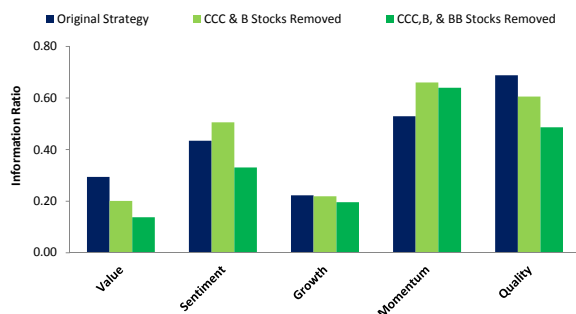
Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Understandably, investors are mostly concerned with performance. Figure 29 and Figure 30 compares the information ratio and maximum drawdown for all the portfolios. Again we find fairly encouraging results. Sentiment and momentum portfolios have better risk adjusted performance and smaller drawdown with SRI exclusions. The performance of value and quality



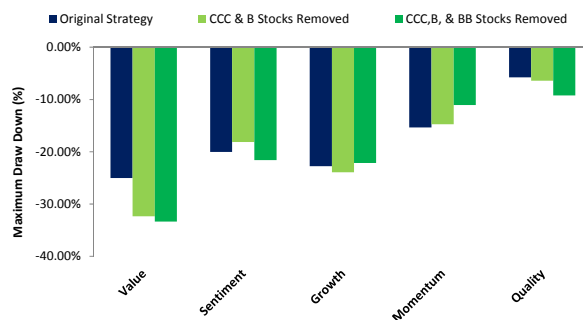
portfolios is slightly lower within an SRI compliant universe. The results of the growth portfolio tend to be unaffected by SRI exclusions.

Figure 29: Information ratio of SRI integration portfolios



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

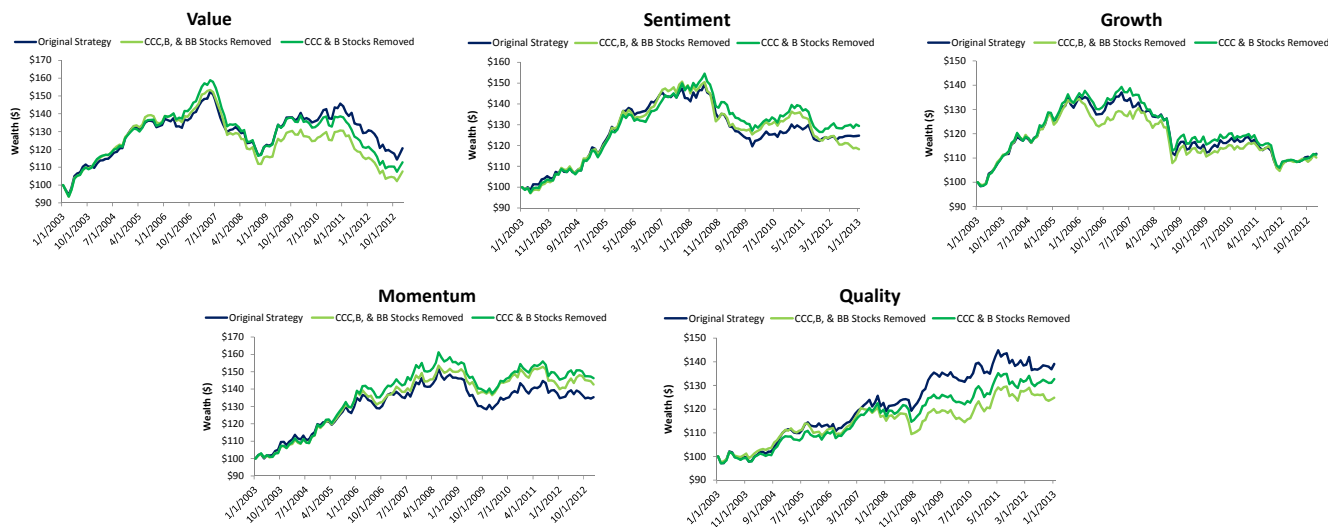
Figure 30: Maximum drawdown of SRI integration portfolios



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Focusing on the wealth curves (Figure 31) we again see similar results. Momentum and Sentiment portfolios tend to outperform within an ESG compliant universe whereas Value and Quality portfolios underperform slightly. The Growth portfolio is unaffected by SRI exclusions.

Figure 31: Active wealth for various optimized portfolios



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Overall the results for SRI integration with mean variance portfolios are fairly encouraging. All the aforementioned portfolio strategies have some view on alpha (i.e. they all incorporate some type of expected return model). In fact, most of the above mentioned portfolio strategies are highly dependent on the alpha model as well as the underlying fundamental dataset. Small changes or error in either the alpha model or the underlying data can significantly change the overall results. As such, it may be better to assess the impact of SRI exclusion under the umbrella of non-alpha strategies. This ensures that the impact of SRI exclusions will not be affected by alpha projections (since there are no alpha forecasts). In fact, it may be a cleaner or purer framework to test the efficacy of SRI integration. We dig deeper into this next.



# Smart Beta SRI Strategies

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## The hype behind “smart beta” strategies

The hype or growth in “smart beta” strategies has been (not surprisingly) fueled by the global financial crisis where investors were more concerned with controlling for risk rather than maximizing return performance. Amid the backdrop of poor performance by market capitalization weighted indices, smart beta strategies have become more popular. Smart beta strategies are loosely defined to be investments that capture the return to the equity asset class, but attempt to do so in a more risk-efficient manner (i.e. achieving better risk adjusted performance than the market).

These rule based strategies define the weights of individual assets based on individual/common asset risks or fundamentals. Examples of smart beta strategies include: risk parity or equal risk contribution, maximum diversification, minimum variance, inverse volatility, fundamental indexing etc. The adoption of such strategies is justified by a multitude of arguments including: returns are becoming more difficult to forecast so it may be more worthwhile to focus on reducing overall portfolio risk and increase diversification, certain active and quantitative strategies may be less transparent and thereby more difficult to evaluate and understand whereas smart beta strategies are typically rule based, market cap weighted indices are suboptimal in that they typically overweight overvalued stocks and underweight undervalued stocks etc.

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## Review of smart beta strategies

Here we review the formulation of five common smart beta strategies: equally weighted inverse volatility, equal risk contribution (risk parity), minimum variance, and maximum diversification.

### Equally Weighted:

Equally weighted or EW is by far one of the simplest smart beta strategies where individual stocks (i.e. assets) weighted equally. Mathematically, this can be expressed as follows:

$$w_i = \frac{1}{n}$$

where  $n$  is the number of assets in the portfolio at a particular point in time.

### Inverse Volatility:

The first allocation technique we explore is Inverse Volatility (IV), a naïve risk parity based allocation technique. The lure of the IV allocation is its simplicity. In this scheme, assets are weighted inversely to their volatility. As such, more volatile assets are relatively down weighted and less volatile assets are relatively up weighted. Mathematically, this can be expressed as follows:

$$w_i = \frac{1/\sigma_i}{\sum_n 1/\sigma_i}$$



Computational IV is easy to implement. However, the ease of implementation naturally comes at a cost. The main drawback of IV is that it does not take into account the correlation between portfolios. Similar to other naïve allocation techniques, IV does not take into account correlation. The issue lies in that an asset may be unnecessarily penalized (i.e. down weighted) simply because it's relatively more volatile. For example, a more volatile portfolio which is negatively correlated to the other portfolios would be down weighted removing some diversification benefit. The above equation is subject to the constraint that all the weights in the portfolios are non-negative and are renormalized to sum to 100%.

### Equal Risk Contribution (Risk Parity):

The allure of the risk parity (RP) or equal risk contribution (ERC) allocation strategy is that it seeks to give equal risk budget to each asset in the portfolio. As such it strives to down or up weight each asset so that each asset's risk contribution to the overall portfolio is equal. ERC takes into account the correlation between the associated assets. And it can be implemented via an optimization problem based on the following equation:

$$\arg \min_w \sum_{i=1}^n \sum_{j=1}^n [w_i \text{cov}(r_i, r_p) - w_j \text{cov}(r_j, r_p)]^2$$

where  $r_i$  and  $r_j$  are the returns of the each underlying momentum portfolio and  $r_p$  is the overall portfolio return. The above equation is subject to the constraint that all the weights in the portfolios are non-negative and sum to 100%.

### Minimum Variance

The next portfolio allocation method we look at is the widely discussed Minimum Variance (MVP) method.<sup>5</sup> The MVP method aims to weight portfolios such that the overall portfolio risk is minimized without taking any particular view on expected portfolios returns. This can be implemented via an optimization problem based on the following equation:

$$\arg \min_w \frac{1}{2} w' \Sigma w$$

The above equation is subject to the constraint that all the weights in the portfolios are non-negative and sum to 100%.

### Maximum Diversification:

Next we look at Maximum Diversification (MD).<sup>6</sup> This allocation strategy attempts to create portfolios that are more diversified by maximizing the distance between the weighted average volatility of each underlying portfolio and the overall portfolio volatility. This can be shown in the following equation:

$$\arg \max_w \frac{\sum w_i \sigma_i}{w' \Sigma w}$$

<sup>5</sup> For a more detailed analysis of Minimum Variance portfolios, please see Alvarez et al. [2011b]

<sup>6</sup> For more information on Maximum Diversification, please see Alvarez et al. [2011c]



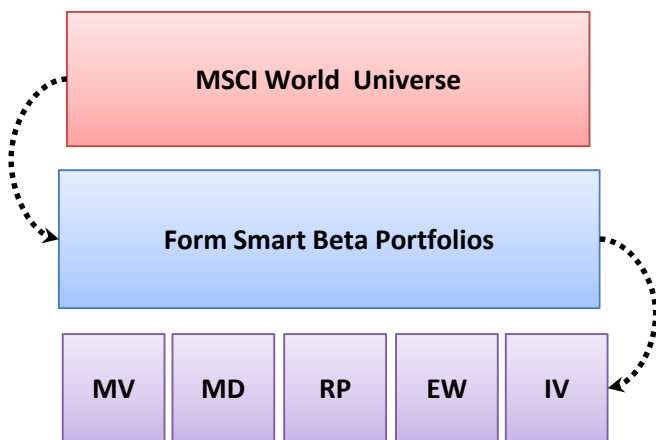
The equation above warrants some further explanation. The numerator is simply the weighted sum of the underlying portfolio volatilities. The denominator is the total portfolio volatility which takes into account the correlation between the underlying portfolios. The difference between the two is essentially the correlation component within the denominator. To maximize the overall ratio, the denominator containing the correlations must be minimized. This allocation strategy attempts to select portfolio weights that minimize the correlation between the underlying portfolios and hence “maximize diversification” as the name suggests. Next, we discuss our SRI integration methodology with smart beta portfolios.

## Integrating SRI with “smart beta”

Figure 32 illustrates our ESG integration framework within smart beta portfolios. Initially we evaluate the portfolio performance within the entire stock universe (i.e. MSCI World). We then test the performance within an ESG compliant universe. Finally, we compare the performance of both strategies to gauge the impact of the SRI integration. Both portfolios are long only with no leverage, but no other constraints are applied. Avoiding constraints allows us to best gauge the direct impact of SRI exclusions. However, later we show the portfolio impact with typical institutional constraints on smart beta portfolios.

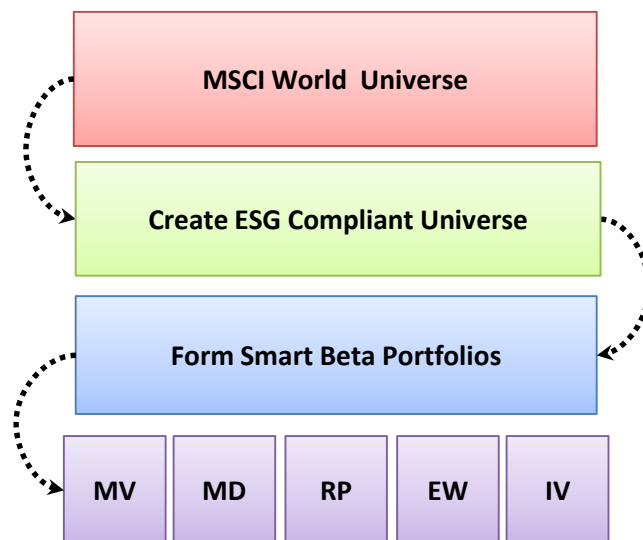
We apply our SRI integration framework to five smart beta portfolio strategies (i.e. MV, MD, RP, EW, IV as well as the benchmark) and analyze the performance results. To form our ESG compliant universe, we exclude CCC, B, and BB rated stocks from MSCI World (i.e. ESG Compliant Universe). We utilize the global Axioma risk models to estimate our covariance matrix. Our backtesting frequency is monthly and the period is from 2003 to 2013.

Figure 32: Smart beta portfolio framework



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 33: SRI smart beta integration framework



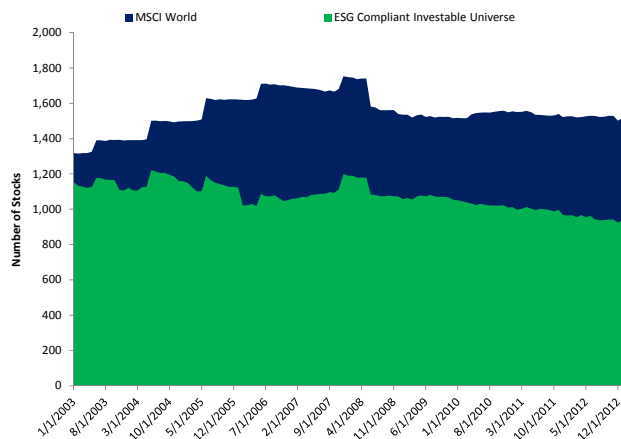
Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

First, we preview the coverage for ESG compliant investable universe. This is the ESG compliant investable universe for all the smart beta strategies. Recall that the ESG compliant universe excludes CCC, B, and BBB rated stocks from MSCI World. Figure 34 compares the coverage between MSCI World and the



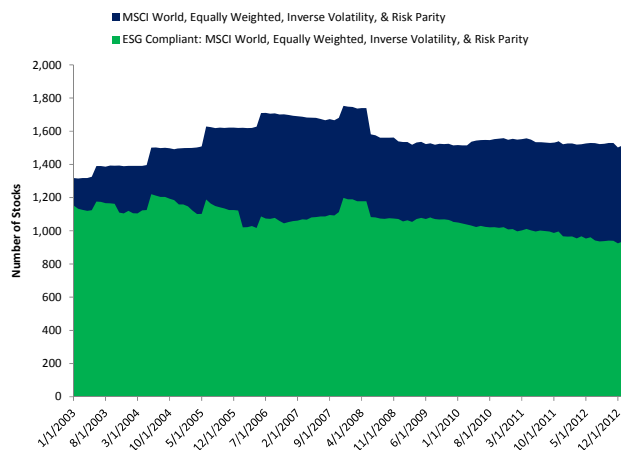
ESG compliant investable universe. The coverage difference between both universes is fairly significant. This will enable us to directly assess the impact of ESG exclusions.

Figure 34: ESG compliant investable universe



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

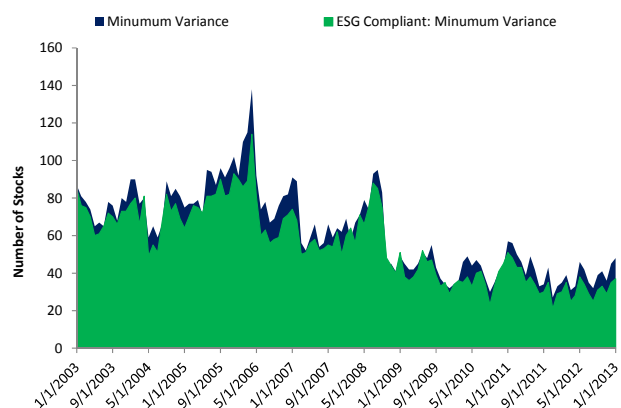
Figure 35: ESG compliant coverage on EW, IV, and RP



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

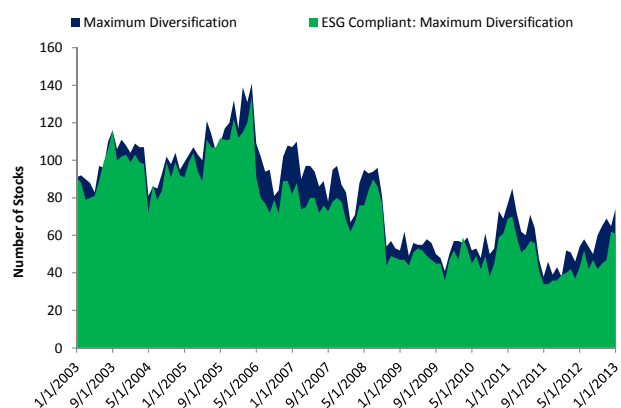
Next we apply all the smart beta strategies to MSCI World and the ESG compliant universe and compare the performance results. Again, first and foremost we compare the coverage. Analyzing this requires some forethought. By construction, equally weighted, inverse volatility, and risk parity utilize all of the stocks in the investable universe whereas minimum variance and maximum diversification utilize only a portion of the stocks in the investable universe. As such, we separate the coverage analysis into two parts. Figure 35 compares the coverage between MSCI World and the ESG compliant universe after applying EW, IV, and RP. Figure 36 and Figure 37 compare the coverage between MSCI World and the ESG compliant universe after apply MV and MD respectively. Next, we discuss the performance results.

Figure 36: Coverage comparison for minimum variance



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 37: Coverage comparison for maximum diversification



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

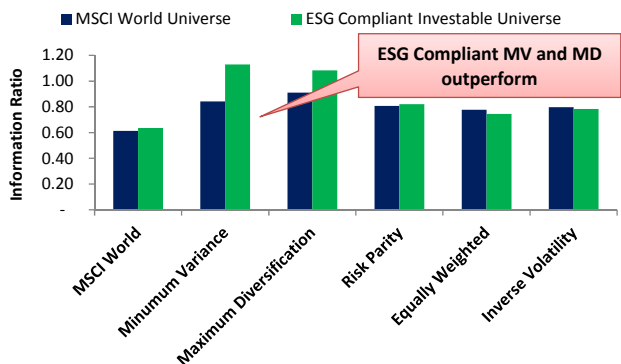
Figure 38 compares the information ratio between MSCI World and the ESG investable universe after applying the smart beta allocation techniques. First,



we note that all the smart beta allocation techniques outperform MSCI World (which has an sharpe ratio of approximately 0.6) on a risk adjusted basis. The raw ESG compliant universe also performs in line with MSCI World on a risk adjusted basis. This is interesting because it implies that if you have a portfolio strategy that closely mimics MSCI World (i.e. has very low tracking error to MSCI World), applying an ESG exclusion screen to this portfolio may produce similar risk adjusted performance to MSCI World.

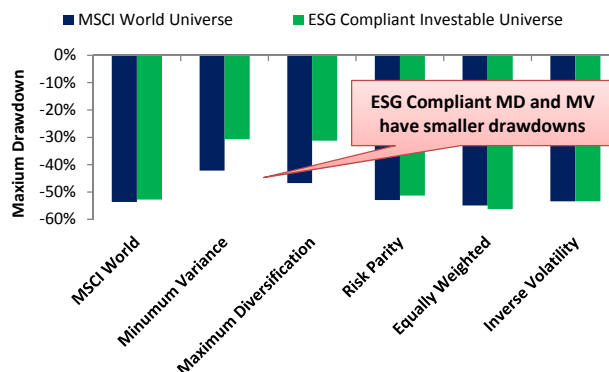
We also find that RP, EW, and IV perform inline. This suggests that investors managing these types of portfolio strategies can potentially apply ESG based exclusions with minimal impact on risk adjusted performance. However, the most noteworthy finding is that MV and MD outperform within an ESG compliant investable universe. Not only do MV and MD outperform on a risk adjusted basis within an ESG compliant universe, they also incur smaller drawdown (Figure 39). Other smart beta strategies incur the same level of drawdown irrespective of the universe.

Figure 38: Information ratio for unconstrained smart beta portfolios



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 39: Maximum drawdown for unconstrained smart beta portfolios



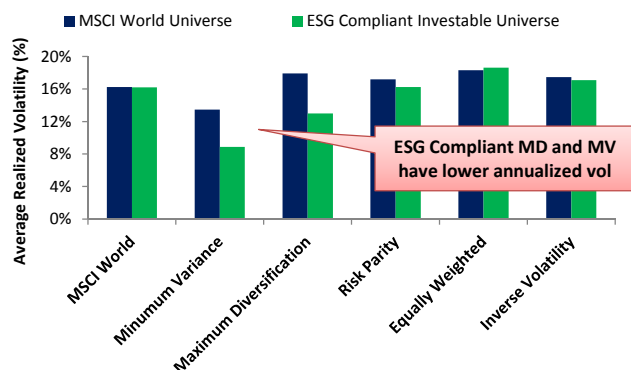
Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Interestingly, the average annualized realized volatility (Figure 40) for MV and MD is significantly lower within an ESG compliant universe. Comparing the other smart beta portfolios within MSCI and an ESG compliant universe, we find the realized portfolio volatility to be fairly inline. Lastly, looking at the average annualized return (Figure 41), we find that results to be fairly similar between all the smart beta portfolios albeit for MV and MD the annualized return is slightly lower within an ESG compliant universe. As such the outperformance in risk adjusted return for MV and MD within an ESG compliant universe is attributable to lower overall portfolio volatility and not stronger returns.



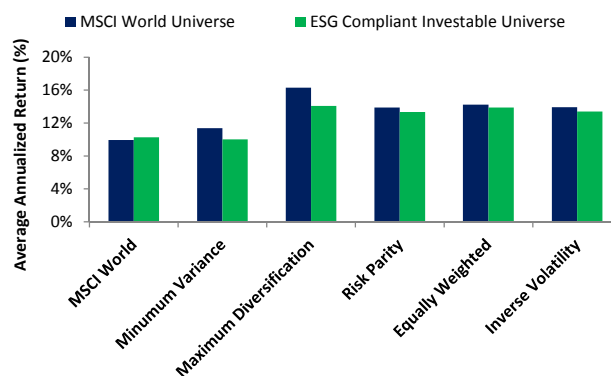


Figure 40: Average annual realized volatility for unconstrained smart beta portfolios



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 41: Average annual return for unconstrained smart beta portfolios



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

The outperformance we observe with MV and MD within an ESG compliant universe is surprising. On the surface it implies that if investors who were running such strategies applied an ESG exclusionary screen, they may have achieved greater risk adjusted performance. However, these results are also quite puzzling. What is causing MV and MD portfolios to have greater risk adjusted performance and lower realized volatility? Is there an intended or unintended sector or country bet that is causing this outperformance? How different are the portfolio properties when an ESG exclusionary screen is applied? Are these differences causing the outperformance with MV and MD? In the coming sections, we want to address all these issues to better understand why MV and MD are outperforming within an ESG compliant universe.

Disentangling smart beta portfolios is not an easy feat. We have seen some academic papers corroborating that MV and MD outperform in an ESG compliant universe.<sup>7</sup> However, we have seen very little discussion explaining the reason for this outperformance. In this section, we hope to shed some light on why MV and MD outperform within an ESG compliant universe. We may not fully answer all the questions but the goal is to better understand the potential reasons for this outperformance so that we can better manage and position SRI integration strategies.

We begin the analysis by first comparing the country exposure of the ESG compliant MV portfolio to the MV portfolio based on MSCI World (Figure 42) where no companies are excluded. The upper portion of the chart shows the countries that are overweight within the ESG compliant MV portfolio relative to the MV portfolio formed from MSCI World. Conversely, the lower portion of the chart shows the countries that are underweight within the ESG compliant portfolio. Could the ESG exclusions somehow be causing the optimization to hone in on less volatile markets and shy away from riskier markets? We don't see any evidence of this from the figure below. Belgium is overweight to some degree within the ESG compliant portfolio. Japan is slightly underweight prior to 2007. We don't find any evidence of a tilt towards more stable and highly developed markets. We find similar results when analyzing the MD portfolio (Figure 43).

The chart illustrates the relative weight of various countries in the ESG compliant MV portfolio from 1/1/2003 to 1/1/2013. The Y-axis represents the Relative Weight (%) from -60% to 80%. The X-axis shows dates from 1/1/2003 to 1/1/2013. A red arrow points upwards, indicating overweight countries (positive relative weight), and a green arrow points downwards, indicating underweight countries (negative relative weight). Belgium and Japan are highlighted as specific examples.

**Overweight countries in ESG compliant MV portfolio**

**Underweight countries in ESG compliant MV portfolio**

**Belgium**

**Japan**

**Legend:**

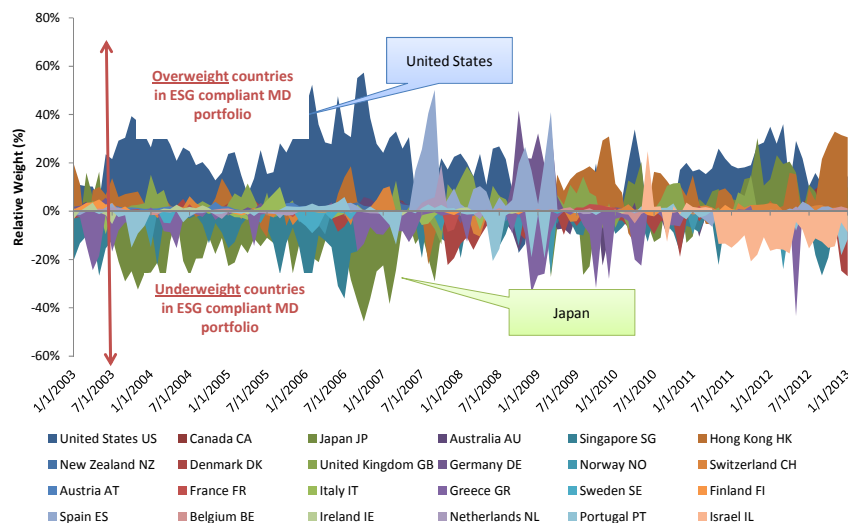
- United States US
- Canada CA
- Japan JP
- Australia AU
- Singapore SG
- Hong Kong HK
- New Zealand NZ
- Denmark DK
- United Kingdom GB
- Germany DE
- Norway NO
- Switzerland CH
- Austria AT
- France FR
- Italy IT
- Greece GR
- Sweden SE
- Finland FI
- Spain ES
- Belgium BE
- Ireland IE
- Netherlands NL
- Portugal PT
- Israel IL

<sup>7</sup> For more details, see: Bertrand et al., 2013, “Smart Beta Strategies: The Social Responsibility of Investment Universes Does Matter”, *Deutsche Bank Quantitative Strategy*, April 2013.



The ESG compliant MD portfolio is tilted towards the US and away from Japan. However, this is only up until 2007. Thereafter, the country tilts are fairly benign. Perhaps analyzing the sector exposure can shed some more light.

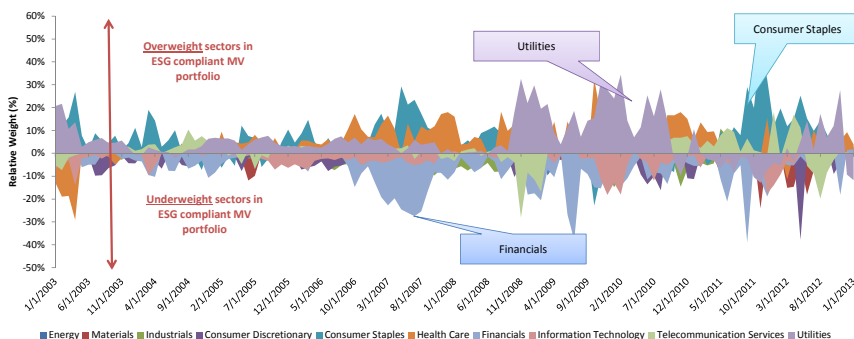
Figure 43: MD relative country exposure



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 44 compares the sector exposure of the ESG compliant MV portfolio to the MV portfolio based on MSCI World where no companies are excluded. Interestingly, low volatility sectors such as Utilities and Consumer Staples are overweight within the ESG compliant portfolio. Financials is predominantly underweighted especially during the financial crisis. Perhaps this tilt towards low volatility sectors and a tilt away from financials is one of the reasons why ESG MV has outperformed. These results suggest that screening out low rated ESG stocks positions the MV portfolio towards less volatile sector allocations before the financial crisis and the risk on/off environment that followed.

Figure 44: MV relative sector exposure

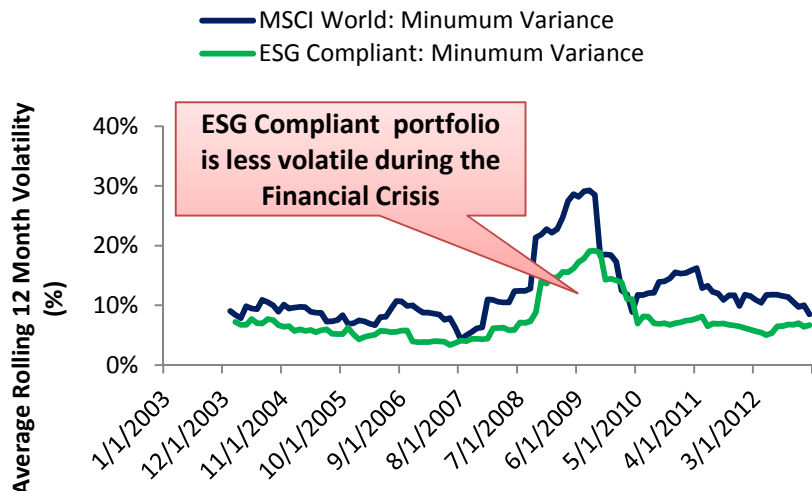


Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Comparing the time series volatility between MV within MSCI World and an ESG compliant universe (Figure 45), we clearly see that the MV ESG compliant portfolio has lower portfolio volatility especially during the Financial Crisis and thereafter.



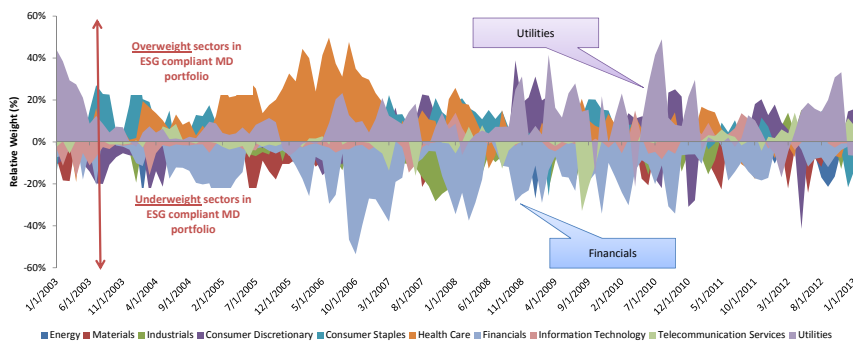
Figure 45: MV portfolio volatility



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Performing the same analysis for the MD portfolio yields similar results (Figure 43). The ESG compliant MD portfolio is tilted towards Utilities and away from Financials.

Figure 46: MD relative sector exposure

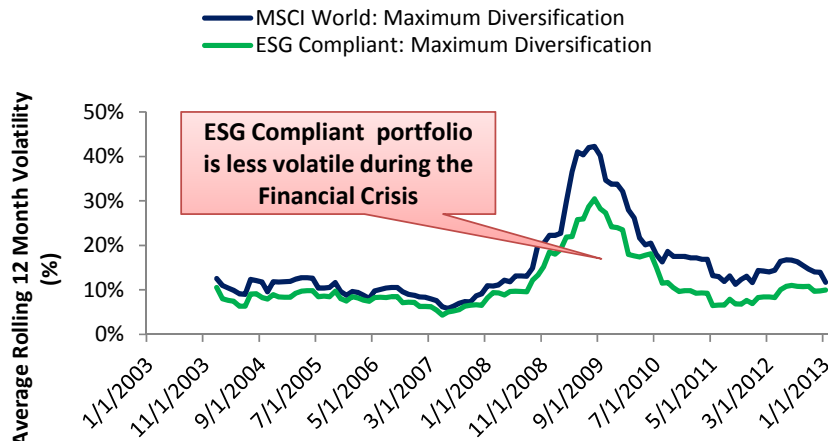


Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Comparing the time series volatility between MD within MSCI World and an ESG compliant universe (Figure 47), we again see that the MD ESG compliant portfolio has lower portfolio volatility especially during the Financial Crisis and thereafter.



Figure 47: MD portfolio volatility



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

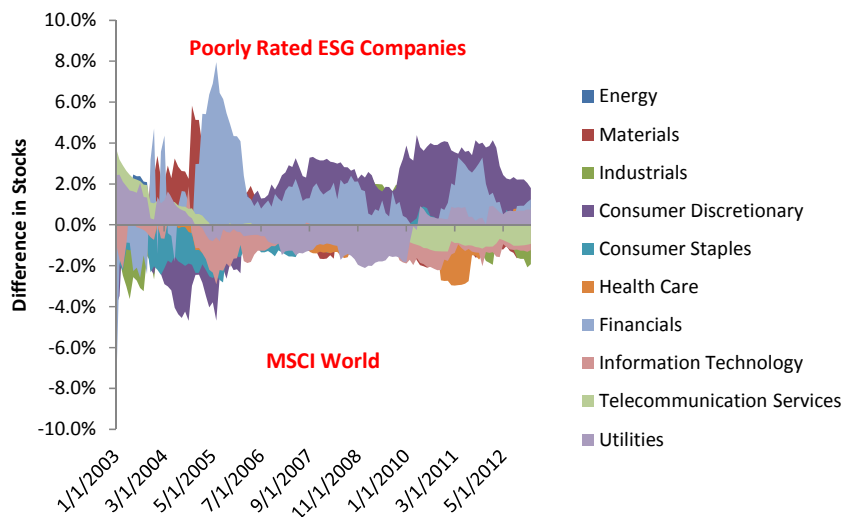
This tilt towards lower volatility sectors may help explain to some extent the outperformance of MV and MD within an ESG compliant universe. However, let's dig even deeper to see if we can uncover any other interesting portfolio traits.

## The makeup of poorly rated ESG companies

Building upon our previous findings, here we look at the sector makeup of poorly rated ESG companies. We analyze the sector constituent exposure which is simply the number of companies within each sector. We start off the analysis by first comparing the sector constituent exposure of the poorly rated ESG companies (that have been excluded) compared to MSCI World where no companies are excluded (Figure 48). The upper portion of the chart shows the sector constituent exposure of poorly rated ESG companies where as the lower portion of the chart shows the sector constituent exposure of the MSCI World. Interestingly, we see that poorly rated ESG companies consist of financials and consumer discretionary as compared to MSCI World. By excluding poorly rated ESG companies from our investable universe, we are in fact, excluding more volatile sectors like financials and consumer discretionary.



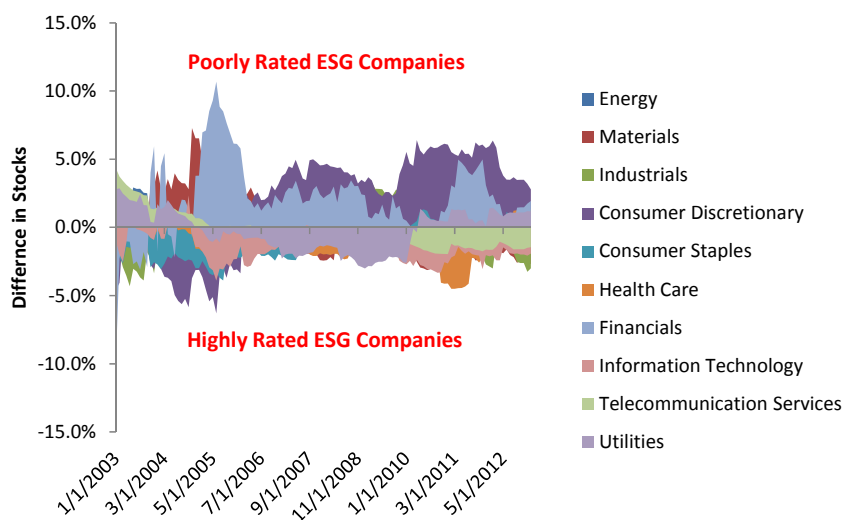
Figure 48: Sector constituent makeup (Poorly rated ESG companies versus MSCI World)



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Additionally, we compare the sector constituent exposure of poorly rated ESG companies versus highly rated ESG companies (Figure 49). We again see the same pattern. Poorly rated ESG companies mostly consist of financials and consumer discretionary stocks whereas as highly rated ESG companies are mostly composed of Utility stocks. This sector makeup tilt of does help explain why an ESG compliant universe is less volatile as compared to the MSCI World. Next we look at the impact of ESG integration on portfolio diversification and correlation.

Figure 49: Sector constituent makeup (poorly versus highly rated ESG companies)



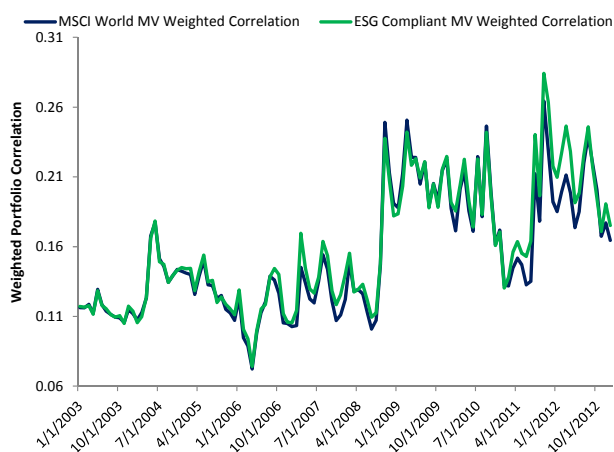
Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy



## Portfolio correlation and diversification

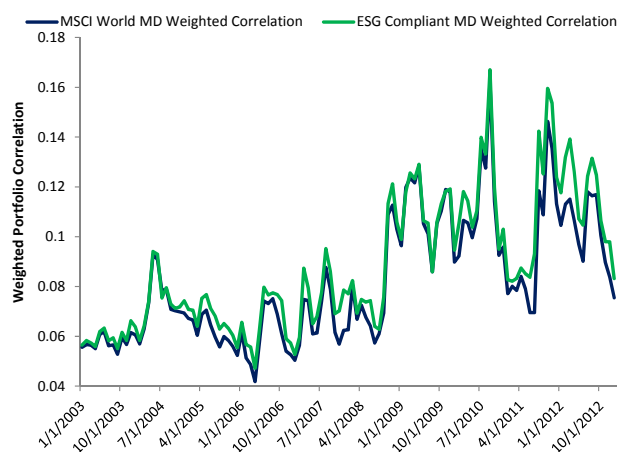
Here we examine the level of correlation and diversification within the MV and MD portfolios. Do the ESG exclusions decrease the level of correlation and increase diversification thereby reducing the overall portfolio volatility? We use two measures to test this hypothesis: the weighted portfolio correlation (WPC) and the diversification ratio (DR).<sup>8</sup> WPC simply measures the level of portfolio correlation taking into account individual asset weights whereas naïve methods of measuring correlation simply utilize asset returns. WPC is closely related to DR which is simply a measure of portfolio diversification. Figure 50 and Figure 51 show the time series WPC for the MV and MD portfolios respectively. First, we note that both MD portfolios have a lower level of correlation when compared to the MV portfolios. This is of course expected as the objective of the MD portfolio is to minimize correlation (i.e. maximize diversification). More importantly, we see no significant difference in WPC between the ESG compliant portfolios and the portfolios formed from MSCI World. The ESG compliant portfolios are slightly more correlated (i.e. less diversified).

Figure 50: WPC for MV portfolios



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 51: WPC for MD portfolios



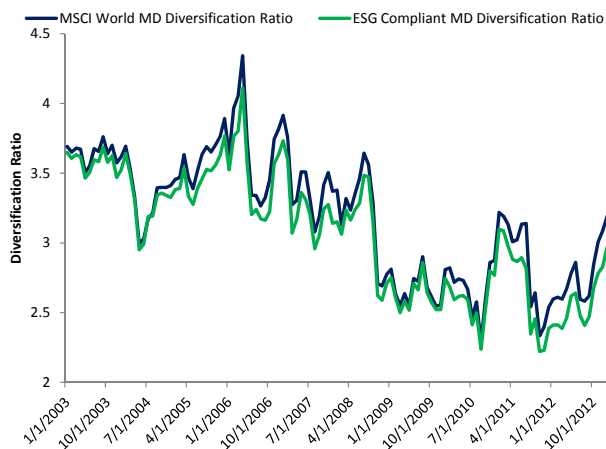
Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

We can see this more clearly by looking at the time series DR of the portfolios (Figure 52 and Figure 53). The ESG compliant portfolios are less diversified albeit very slightly.

<sup>8</sup> For more information on WPC and DR, please see: Luo et al., 2013, "Portfolios Under Construction: DB Handbook of Portfolio Construction: Part 1", Deutsche Bank Quantitative Strategy, 30 May 2013..

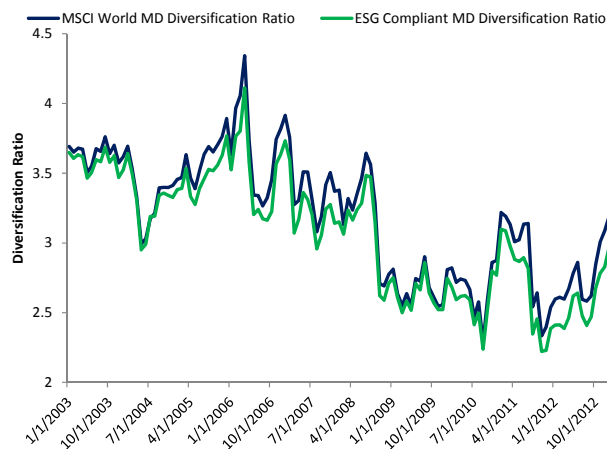


Figure 52: DR for MV portfolios



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 53: DR for MD portfolios



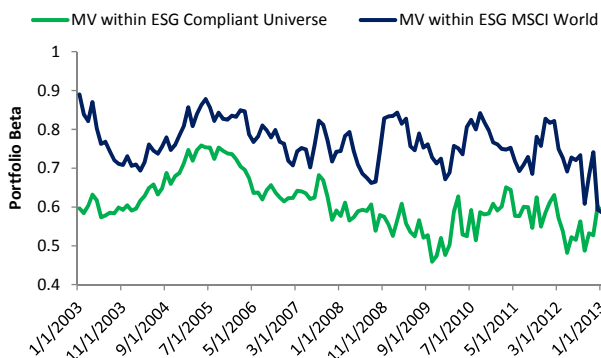
Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Analyzing the WPC and DR did not shed any new light on explaining the outperformance of MV and MD; however, it did show that ESG integration within an MV or MD portfolio will not cause a significant shift in the level of portfolio correlation or diversification. Next, we investigate the beta exposure of the portfolios.

## The BETA in smart beta

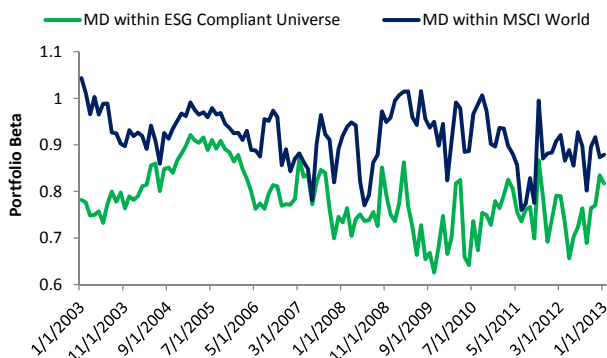
Perhaps analyzing the beta of all the portfolios can tell us something. Figure 54 and Figure 55 show the portfolio CAPM beta for MD and MV. We can clearly see that the ESG compliant MV and MD portfolios have lower portfolio beta. This is interesting as it hints as to why the ESG compliant MV and MD portfolios exhibit lower levels of volatility and thus better risk adjusted performance. Perhaps it is the lower beta exposure? But beta may not be the only exposure.

Figure 54: MV portfolio beta



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 55: MD portfolio beta



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

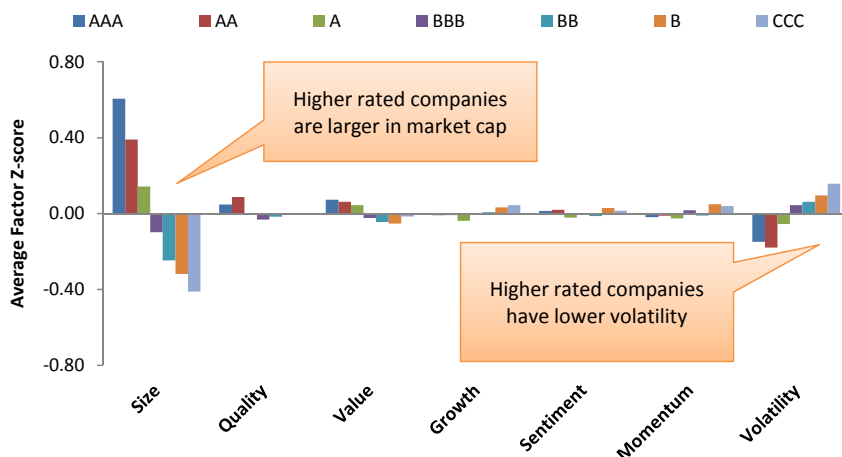




## The size exposure

Recall that when we initially analyzed the underlying MSCI ESG dataset, we found that on average higher ESG rated companies are larger in market cap and poorly rated ESG companies were smaller in market cap (Figure 56). When we exclude poorly rated ESG companies from our investment universe, we are in fact excluding on average smaller cap companies. Could this size tilt somewhat help explain the performance results of MV and MD?

Figure 56: Factor exposure for Global companies



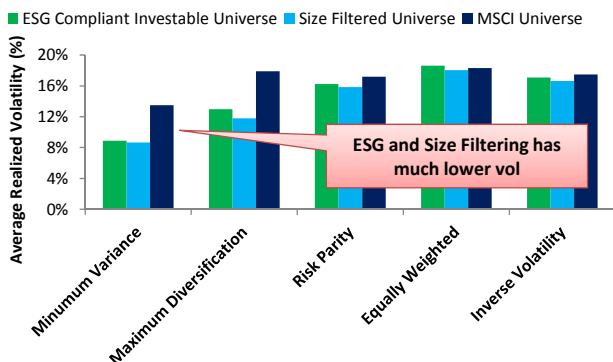
Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

To assess the impact of this size tilt, we run the smart beta portfolios within a size constrained universe. We simply rank all companies based on their USD market cap and remove the companies within the smallest decile from the investable universe. Figure 57 compares the portfolio volatility of the size filtered universe, ESG compliant universe, and the broader, non-screened universe. The results are in fact very interesting. The size filtered universe has lower overall portfolio volatility, similar to the ESG compliant universe. Is the size tilt the reason that MV and MD have outperformed within and ESG compliant universe?

In terms of risk adjusted performance (Figure 58), the size adjusted universe outperforms the broader universe for MV. But on average, the ESG compliant universe outperforms the size adjusted universe. As such we can see that there is an incremental benefit to ESG integration over merely size filtering (another interesting result). It seems that analyzing the size exposure does shed some insight into the analysis of smart beta and SRI. It's of course not the whole story.

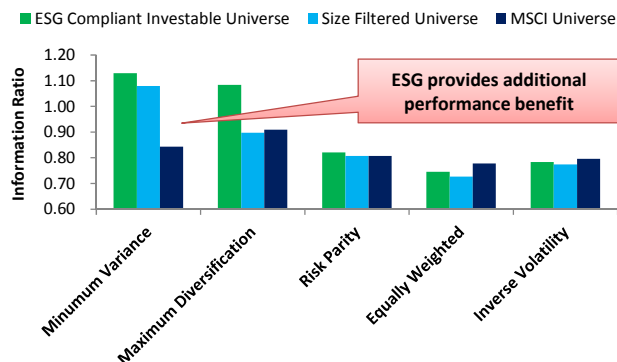


Figure 57: Average annual return for smart beta portfolios



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 58: Information ratio for smart beta portfolios



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

## Our thoughts

The above analysis illustrates a multitude of properties of ESG compliant smart beta portfolios. Here we summarize a few key points as well as provide our own insight:

- Over the backtesting period, we showed that ESG compliant MV and MD portfolios demonstrated better risk adjusted performance and lower levels of volatility.
- MD and MV ESG compliancy focuses your portfolio towards less volatile sectors such as utilities and consumer staples and tilts your portfolio away from more volatile sectors such as financials and consumer discretionary.
- MD and MV ESG compliant portfolios showed significantly lower volatility especially during the Financial Crisis likely as a result of the tilt away from Financials. Additionally, ESG compliant MD and MV portfolios have lower portfolio beta.
- ESG compliant MV and MD portfolios do not show a significant country tilt. Moreover, ESG compliancy did not significantly affect the diversification ratio of MV and MD portfolios.
- Simple ESG screening techniques on un-optimized and optimized portfolios showed no significant impact on performance for a majority of the portfolios backtested.

In summary, ESG compliancy via simple screening and with MV and MD portfolios showed promising results and should definitely be an area of future research and focus for investment managers with an ESG mandate. However, we should point out that results may vary depending upon the underlying vendor dataset and backtesting period. Data vendor's methodology, data sources, and normalization techniques tend to differ. As such investment managers need to fully understand the underlying characteristics of their chosen ESG data vendor. Results may also differ depending upon the selected optimizer, risk model, and portfolio constraints.

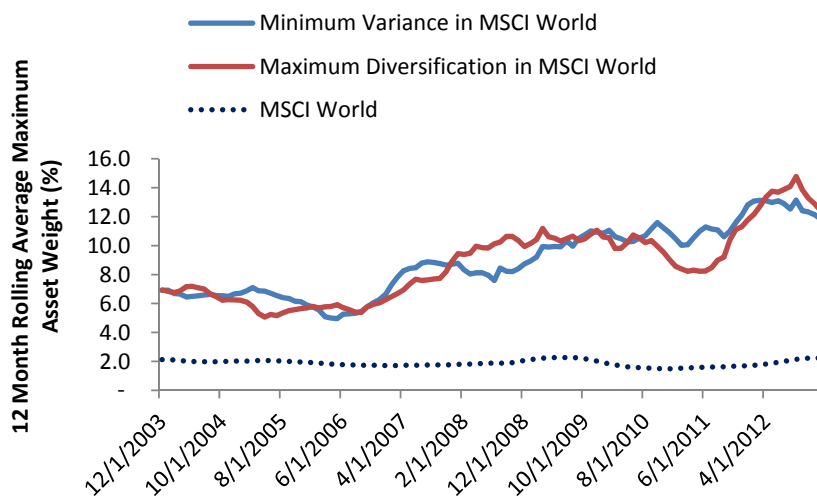


# Practical Considerations

## Practical considerations

Some investors may find it impractical to implement unconstrained smart beta portfolio strategies. This is because an unconstrained smart strategy has the propensity to take on a significant amount of exposure to a select group of assets. Figure 59 shows the maximum rolling asset weight for MV, MD, and MSCI World. We see that some assets can take on a significant weight in the portfolio (i.e. more than 15%). This undoubtedly exposes the portfolio to a significant amount of stock specific risk. As such, managers will often constrain their smart beta portfolios so that they are not excessively exposed to a selected group of assets.

Figure 59: Max rolling asset weight



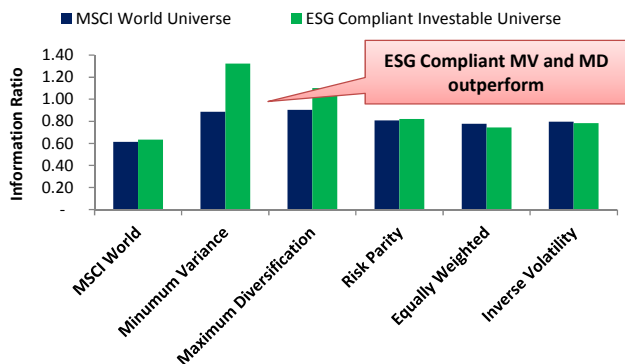
Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

From our perspective, we want to ensure that our results are robust to portfolio constraints. As such, we retest the smart beta strategies after applying a 5% maximum stock weight constraint. Do our results still hold up with this constraint? Figure 60 to Figure 63 show the results of our analysis.

Note that the 5% asset weight constraint will only impact the MD and MV portfolio. The other smart beta portfolios will generally not have asset weights greater than 5%. In summary, we find that MV and MD continue to outperform on a risk adjusted basis after applying portfolio constraint. This yet again strongly suggests that ESG compliant MV and MD strategies can be implemented while adhering to real world institutional constraints.

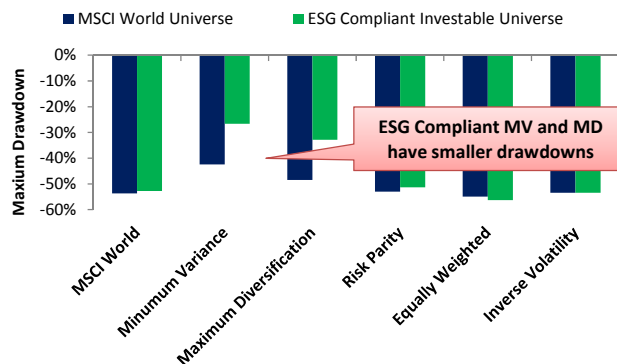


Figure 60: Information ratio for constrained smart beta portfolios



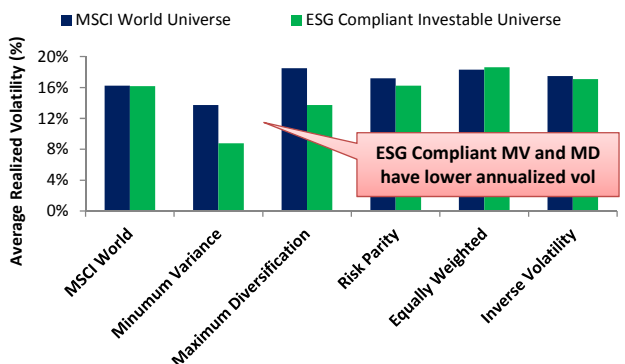
Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 61: Maximum drawdown for constrained smart beta portfolios



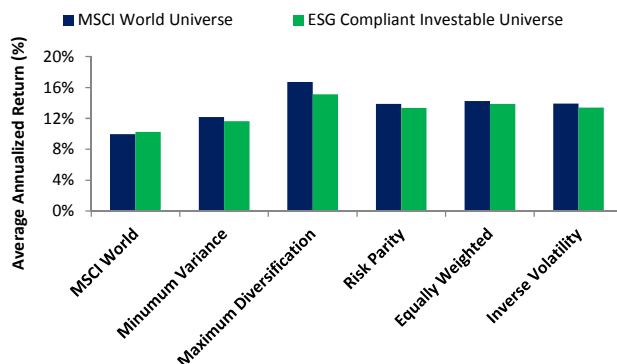
Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 62: Average annual realized volatility for constrained smart beta portfolios



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy

Figure 63: Average annual return for constrained smart beta portfolios



Source: MSCI ESG Research, Compustat, IBES, Russell, S&P, Thomson Reuters, MSCI, Deutsche Bank Quantitative Strategy



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# Appendix 1

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Global Head of Research

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Global Head  
CB&S Research

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### Deutsche Bank AG

Deutsche Bank Place  
Level 16  
Corner of Hunter & Phillip Streets  
Sydney, NSW 2000  
Australia  
Tel: (61) 2 8258 1234

### Deutsche Bank AG

Große Gallusstraße 10-14  
60272 Frankfurt am Main  
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