
A BLUEPRINT FOR INTEGRATING ESG INTO EQUITY PORTFOLIOS

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Environmental, social and governance (ESG) offers a source of new and potentially valuable information for investors, impacting both potential returns and risk. Growing data availability has created the opportunity to integrate ESG into equity portfolios for a variety of investment processes, for both indexing and active management. In this paper, we provide an overview of the current data landscape and several popular methods for integrating ESG. A main challenge is that ESG data collection and aggregation methods can vary significantly across providers, leading to very different ratings for the same company. If the data issues are properly addressed, integrating ESG has important potential benefits for investors. Our “blueprint” lays out a path for any investment manager seeking to understand how ESG fits into their investment process.



1 Why ESG?

Environmental, social and governance (ESG) investing has become front and center for many

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investors as more and more research shows it has implications for both risk and return. As of the most recent estimates, there are approximately \$22.89 trillion of assets being professionally managed under “sustainable” or “responsible” investment strategies (GSIA, 2016). In relative terms, ESG-related investments now account for approximately 26% of all professionally managed assets globally.

It is now well-known that ESG is shorthand for environmental, social and governance metrics. Environmental examples include climate change, greenhouse gas emissions, resource depletion including water, waste and pollution, and deforestation. Social examples include working conditions, health and safety, employee relations, and diversity. Governance examples include

executive pay, bribery and corruption, political lobbying and donations, board diversity and structure, and tax strategy.

One could argue that it was historically the job of the security analyst to assess these issues and price them in. The proliferation of quantifiable data has made it possible to easily incorporate ESG into data-driven strategies from active quantitative strategies to index portfolios. The rest of this paper sets out a blueprint for investment managers and how they might go about incorporating ESG into their investment process. Our insights reflect our own experience with a mix of institutional and individual investors whose ESG needs have evolved rapidly in recent years. We discuss some of the challenges for integrating ESG into equity portfolios and provide several real-life examples of doing so in practice.

2 The ABCs of ESG data

2.1 ESG data standards and reporting requirements

The foundation for integrating ESG starts with data. The data challenges originate with the fact that companies have historically not been formally required to report their internal initiatives on environmental, social, and governance factors. In the US, ESG metrics are self-reported, based on the notion of “material information” introduced in 1976 by the U.S. Supreme Court.¹ “Materiality, as defined by the courts, recognizes that some information is important to investors in making investment and voting decisions, while other information is not” (SASB, 2016). Companies are not given formal standards from regulatory agencies as to what ESG data is *material*; they determine for themselves which ESG factors are material and what information should be disclosed to investors.

In Europe, more formal ESG standards are evolving. The Accounting Directive² on disclosure of non-financial and diversity information by certain large companies was approved in December 2014. Member states are in the process of transposing the directive into national laws, and it is expected that the first company reports will be published in 2018.

More broadly, there is no shortage of standards being set forth—the Global Reporting Initiative (GRI), United Nations Global Compact (UNGC), International Integrated Reporting Council (IIRC), International Standards Organization (ISO), and Sustainability Accounting Standards Board (SASB). However, without legal requirements for reporting, standardization of data is still a long way off.

2.2 ESG data and ratings methodologies

Despite the absence of clear standards, ESG data has come a long way in recent years. There are a number of prominent ESG data providers today with proprietary ESG metrics and ratings systems. As of 2016, there were over 125 organizations providing ESG ratings and research (GISR database). Well-known ESG data providers with global coverage include MSCI, Sustainalytics, Thomson Reuters, Bloomberg, FTSE, Oekom Research, RepRisk, Inrate, RobecoSAM, and VigeoEIRIS. Leading specialized data providers include S&P Trucost, CDP, and ISS. Each ESG data provider has developed its own sourcing process and research methodology. (For prior studies assessing data quality and coverage, see Novethic, 2013; Columbia University Capstone, 2014; Sustainable Insight Capital Management, 2016.)

Not surprisingly, differences in data providers’ methodologies result in significant differences in their ratings. To illustrate, Exhibit 1 shows

Exhibit 1: ESG scores are different across providers (cross-sectional correlation for constituents of the MSCI world index, June 30, 2017).

	Sustainalytics	MSCI	RobecoSAM	Bloomberg ESG
Sustainalytics	1	0.53	0.76	0.66
MSCI		1	0.48	0.47
RobecoSAM			1	0.68
Bloomberg ESG				1

cross-sectional correlations for four of the leading data providers' ESG scores using the MSCI World Index as the coverage universe. The correlation ranges from 0.47 to 0.76 across the aggregated scores. There is clearly weak association across the leading ESG providers.

Given these significant differences across providers, how reliably can we trust the data? What are the key differences across providers and how best should an investment manager account for them? The answers to these questions lie in a careful examination of the underlying methodologies of the data providers. At a general level, we find discernable differences among ESG data providers on raw data sourcing and acquisition methods. First, providers often gather publically available information from different sources. For example, providers can pull raw data from a wide variety of sources including company reports, policy statements, news articles, social media, NGOs, and industry research reports. Second, we observe that providers gather data using different acquisition methods. For example, some research teams rely heavily on large teams of human analysts, while other leverage artificial intelligence software and machine learning techniques to categorize and clean incoming data feeds.

On a more substantive level, we see five key data challenges throughout the ESG integration process that are important to investment research:

- First, each ESG data provider has developed an internal proprietary framework with respect to how it handles *materiality*. Despite the work of GRI and SASB on company standardization, and the GISR (2016) and ARISTA on the ESG ratings standardization, each provider uses different definitions of materiality.
- Second, each ESG data provider has developed an internal methodology regarding defining and *normalizing* this materiality across companies—universal sustainability framework versus industry or peer group.
- Third, each ESG data provider has developed a method to *aggregate* and weight particular ESG factors for its summary scores.
- Fourth, in the absence of required standards and reporting, ESG data providers combine data from companies using traditional sourcing techniques with statistical models that attempt to *estimate* data for unreported companies—based on similar industry and company characteristics.
- Finally, ESG data providers create metrics that target different investor demands—ranging from ESG risk versus opportunities, and quantitative performance versus qualitative metrics.

In sum, while there is increasingly more ESG data available today, the lack of standardization poses a real challenge for investment managers. Because disclosure on ESG metrics has not been required historically, significant variation exists across the methods used by the leading ESG data

providers. This issue does introduce a certain amount of subjectivity and potential noise/risk into the investment process. Still, rather than cynically discard ESG data altogether, we believe that taking a more nuanced view of the data can overcome these challenges, which we explore later in this paper.

2.3 *A comparison of MSCI versus sustainability data*

Next, we turn to a deeper examination of two of the leading providers. We focus on MSCI and Sustainalytics here because both are widely used across asset managers and asset owners, and both offer global ESG product suites—including ESG ratings and carbon products. Exhibit 2 analyzes the particular differences among them. As shown in the table, there are distinct differences in the way the two ESG data providers have decided to handle ESG data challenges.

Regarding the definition of materiality, MSCI relies on a proprietary framework that was built over time by their research team and the acquisition of specialist ESG firms. Sustainalytics, on the other hand, adheres to the definition of materiality laid out by the International Financial Reporting Standards (IFRS). In particular, “information is material if its omission or misstatement could influence the economic decisions of users taken on the basis of the financial statements.

Materiality depends on the nature and amount of the item judged in the particular circumstances of its omission or misstatement” (Sustainalytics, 2017).

Furthermore, the two providers use different sub-groupings when normalizing their ESG scores. MSCI normalizes scores across the GICS sub-industries, whereas Sustainalytics normalizes scores by 42 internally identified peer groups.

Finally, each company employs proprietary weighting models and aggregation techniques. MSCI constructs 37 Key Issue aggregate metrics based on a company’s “risk exposure and risk management” capabilities (MSCI, 2017). Sustainalytics creates 60–80 Key ESG Issue aggregate metrics based on a company’s “preparedness, management capabilities, and performance” (Sustainalytics, 2017).

What about the performance implications of the two ESG scoring schemes—MSCI versus Sustainalytics? We sort securities in the MSCI World by ESG score and divide them into deciles. Exhibit 3 shows the performance of the top and bottom deciles, focusing specifically on the spread between them, i.e., top decile minus bottom decile. This is an easy way to understand how much “alpha” is in these scores and is a standard approach in the industry.

Exhibit 2: Comparison of MSCI and Sustainalytics approaches to ESG scores.

	MSCI	Sustainalytics
Materiality	Proprietary definition of materiality	IFRS definition of materiality
Normalization	Key issue weighted average by GICS sub industry	Key issue weighted average by 42 peer groups
Weighting	Key issue weights (prop model)	Key issue weights (prop model)
Aggregation	37 Metrics	60–80 Metrics
Reported vs. estimated	Reported + estimated	Reported + estimated
Risk-focused vs. opportunity	Risk-focused + opportunity	Risk-focused + opportunity

Exhibit 3: Backtested Performance Using Sustainalytics ESG Scores (January 2010 to December 2016, USD, Gross Returns MSCI World Universe).

	Top Decile	Bottom Decile	Spread
Forward 1 mth Return	0.80%	1.01%	−0.22%
Forward 1 mth Volatility	4.86%	3.76%	2.22%
Forward 3 mth Return	2.34%	2.95%	−0.61%
Forward 3 mth Volatility	7.65%	5.67%	3.87%
Forward 6 mth Return	4.56%	5.80%	−1.24%
Forward 6 mth Volatility	10.82%	7.47%	5.24%
Forward 9 mth Return	6.46%	8.52%	−2.06%
Forward 9 mth Volatility	12.91%	9.00%	6.49%
Forward 12 mth Return	8.83%	11.72%	−2.89%
Forward 12 mth Volatility	15.03%	10.44%	7.77%
Forward 24 mth Return	13.93%	23.27%	−9.34%
Forward 24 mth Volatility	18.89%	13.40%	9.43%
Forward 36 mth Return	24.97%	39.82%	−14.85%
Forward 36 mth Volatility	13.68%	14.07%	8.84%

Spread Return (in percentage) is return to top decile securities, equally weighted, minus bottom decile securities, equally weighted.

Various time horizons are shown. For instance, Forward 1-month return shows the returns to the long–short portfolio over the subsequent month from which the portfolio is formed. This is the return an investor can expect from holding this portfolio and rebalancing it monthly. Forward 3-month return shows the returns to the portfolio over the subsequent 3 months, i.e., the return an investor can expect if he or she holds the portfolio for 3 months. We show different horizons since ESG as a performance signal might be expected to be more effective at longer horizons.

We find in Exhibits 3 and 4 that neither the MSCI nor Sustainalytics ESG scores have alpha attached to it, over any of the horizons.³ Top decile ESG securities however have significantly lower volatility than bottom decile ESG

securities, for MSCI scores consistent with prior research by Dunn *et al.* (2017).

The return results may appear unpromising at first, but the period is relatively short and we caution inferring too much from this data sample. Our results are in line with the literature—studies on the link between financial performance and ESG have been mixed. On the negative side, research from Hong and Kacperczyk (2009), Chava (2011), Bhagat and Bolton (2008), and Manescu (2011) has found no (or negative) linkages between returns and “sin stocks”, environmental strengths, corporate governance, and broad ESG factors, respectively. On the positive side, studies show significant financial benefits for industry-specific materiality important ESG metrics (Khan *et al.*, 2016), corporate

Exhibit 4: Backtested performance using MSCI ESG scores (January 2007 to December 2016, USD, Gross Returns MSCI World Universe).

	Top decile	Bottom decile	Spread
Forward 1-mth return	0.47%	0.67%	-0.20%
Forward 1-mth volatility	5.33%	5.26%	1.52%
Forward 3-mth return	1.47%	2.19%	-0.72%
Forward 3-mth volatility	10.00%	10.11%	2.44%
Forward 6-mth return	3.13%	4.66%	-1.53%
Forward 6-mth volatility	15.41%	15.67%	3.74%
Forward 9-mth return	4.45%	6.79%	-2.34%
Forward 9-mth volatility	18.93%	19.16%	3.95%
Forward 12-mth return	5.51%	8.95%	-3.45%
Forward 12-mth volatility	21.19%	22.30%	4.74%
Forward 24-mth return	11.94%	19.29%	-7.34%
Forward 24-mth volatility	29.30%	34.19%	9.36%
Forward 36-mth return	21.16%	32.56%	-11.40%
Forward 36-mth volatility	25.10%	30.96%	10.92%

Spread Return (in percentage) is return to top decile securities, equally weighted, minus bottom decile securities, equally weighted.

governance (Gompers *et al.*, 2003), board diversity (Carter *et al.*, 2010), board structure (Bonn, 2004), employee engagement (Eccles *et al.*, 2014; Edmans, 2012), firm culture (Bauer and Hann, 2010), relationships with stakeholders (Goss and Roberts, 2011), and gender diversity (Wang, 2016).

In the next section, we look at practical examples of how ESG can be used in different portfolio constructs.

3 How can investment managers integrate ESG into equity portfolios?

In this section, we consider how to integrate ESG into different investment processes. Focusing on equity portfolios, there are three distinct categories:

- Indexing (Passive)

- Active Quantitative
- Active Fundamental

For Active Fundamental and Active Quantitative Equity processes, the objective of the investment team is to select those ESG metrics (be it individual metrics such as carbon or a broader aggregate score from one of the data providers) that can help security selection or risk mitigation. Active equity research teams are likely to proceed by surveying the literature, conduct their own empirical analysis, assess how ESG fits with their existing investment process, and select/weight ESG metrics accordingly.

A key dimension is the horizon of the investment process. There may be appropriate ESG metrics for different horizons depending on how quickly the investment strategy is designed to turn over. For example, if the manager has deep value with a

long horizon, ESG may be more appropriate than for a momentum-oriented manager with a shorter horizon. ESG should also be balanced against the investment strategy's primary goals which may be valuation-driven or growth at a reasonable price or a mix of various investment drivers.

Finally, active managers can use ESG as a risk metric to control the exposure at the portfolio level to ESG. The next and last section shows how index managers can start to leverage the rich information in ESG data to build proprietary frameworks that suit their own investment processes.

4 Integrating ESG in indexed portfolios

Within passively managed indexed portfolios, there are many innovations occurring today regarding the integration of ESG. Three use cases that we believe investors may want to consider for their *core equity portfolios* are as follows:

1. **Equity Core Beta (Screened & Cap Weighted):** In this portfolio, we screen the universe based on ESG scores, removing the “worst” rated companies by ESG score, carbon emissions, or some targeted metric. Then we market cap weight the remaining securities. As long as the securities screened out do not comprise a significant part of the starting universe, the final portfolio should be sufficiently broad, liquid, and diversified.
2. **Equity Core Beta (Optimized):** In this portfolio, an optimization framework is employed to design a portfolio that achieves close to benchmark like returns through minimizing tracking error while simultaneously maximizing the ESG score (or minimizing the portfolio's carbon footprint or some other targeted objective). Note that there is a tradeoff between tracking error and ESG profile improvement which can be calibrated depending on the investor's appetite for risk.

3. **Smart Beta Equity Core:** This portfolio's objective is to harness factor premia in a transparent indexed portfolio (i.e., smart beta) while incorporating ESG. This construct is relevant for investors who have adopted a factor-oriented mindset and investment belief.

Using Sustainalytics ESG scores and Trucost carbon scores, we illustrate these use cases above through backtested portfolios. The universe we use is the constituent list for the MSCI World Index. All portfolios are rebalanced quarterly. For the screened portfolio, we remove the bottom 10% by number of securities in the universe. For the smart beta portfolio, we add the relevant ESG score as a sixth factor. Appendix A contains details of the portfolio construction.

Exhibit 5 shows that integrating Sustainalytics ESG scores either by the first or second approach tends to slightly pull back returns. This result is not surprising as we saw in the previous section that there is a negative alpha associated with these scores. The drag of -0.4 basis points and -27 bps respectively in excess returns is not overly large however. The argument can be made that this drag is worth the improvement in ESG characteristics. In the third case, when incorporating ESG into factor portfolios, ESG again tends to pull back returns but in this case, the deterioration in return is more than offset by the premia from the factors. Without ESG, the smart beta equity core portfolio generates approximately 20–40 basis points higher returns at the same level of tracking error.

Exhibit 6 summarizes the results of using Trucost carbon scores. Here, there is a positive performance impact from integrating carbon data. Both Equity Core Beta portfolios historically deliver higher returns and higher Sharpe Ratios than the MSCI World Index benchmark. As in the previous case, the Smart Beta Equity Core portfolio has higher return, this time it is due to both the carbon scores and the factor premia.

Exhibit 5: Three portfolio examples using Sustainalytics ESG scores (Backtested portfolio returns, MSCI World Index Universe, September 2009 to March 2017, USD Gross Returns).

	MSCI World	Equity Core Beta (Screened & Cap Weighted)	Equity Core Beta (Optimized)	Smart Beta Equity Core
Annualized return	9.7%	9.7%	9.4%	12.1%
Average annualized risk	13.4%	13.3%	13.6%	12.1%
Annualized active return	0.0%	-0.004%	-0.27%	2.4%
Average annualized active risk	-	0.3%	1.5%	3.7%
Sharpe ratio	0.72	0.73	0.69	1.00
Information ratio		-0.01	-0.18	0.65

Exhibit 6: Three portfolio examples using Trucost carbon scores (Backtested portfolio returns, MSCI World Index Universe, September 2009 to March 2017, USD Gross Returns).

	MSCI World	Equity Core Beta (Screened & Cap Weighted)	Equity Core Beta (Optimized)	Smart Beta Equity Core
Annualized return	9.7%	10.1%	10.9%	12.8%
Average annualized risk	13.4%	13.3%	13.7%	12.5%
Annualized active return	N/A	0.5%	1.2%	3.1%
Average annualized active risk	N/A	0.4%	1.5%	3.5%
Sharpe ratio	0.72	0.76	0.79	1.02
Information ratio	N/A	1.02	0.77	0.89

5 Making full use of the information set: Refining ESG scores

So far we have looked at integrating ESG through off-the-shelf data. What about the possibility of refining and developing one's own ESG scores? How might active managers go about doing so? Historically, portfolio managers who integrated ESG had dedicated specialized investment research teams and processes. This was necessary because data availability was relatively scarce up until a few years ago, so investment teams needed to create their own data through company-level research, employing a team of analysts to do so.

As data availability has grown, quantifying ESG implications has become easier. This has spurred

a wealth of research studies around ESG. These include many broker reports (e.g., Deutsche Bank, Goldman Sachs, Morgan Stanley, to name a few) showing the empirical results of portfolios sorted on various ESG metrics from employee engagement to environmental risk mitigation. These studies make clear that there is an opportunity for investment managers to construct their own ESG scores without the need for employing a large team of analysts. Today, managers around the world are exploring ESG data and assessing how to integrate this data into their investment processes.

An important recent development is a focus on materiality, building on the notion of "material

information” introduced in 1976 by the U.S. Supreme Court.⁴ Not all ESG metrics are material to all sectors. Some issues, such as Governance related to board composition, have broad applicability across sectors while other issues have more limited scope, such as drug affordability for pharmaceuticals. SASB has been a key driver in shifting the focus towards materiality. SASB, the Sustainability Accounting Standards Board, was founded in 2011 with the mission “to maintain sustainability accounting standards that help public corporations disclose material, decision-useful information to investors in SEC filings”.⁵ The benefits of materiality are confirmed in a recent paper by Khan *et al.* (2016). The authors use the SASB sustainability map to generate a score for each firm that measures only material sustainability issues. Conversely, they also generate a score that utilized only non-material issues. They find that firms that rank well on material issues outperform firms that rank poorly; firms which rank well on material issues but rank poorly on non-material issues are in fact the best performers.

6 Designing an ESG signal: An illustration

Leveraging the materiality framework, how does one create a better ESG score? Evaluating firms on ESG requires evaluating the material information and then creating an overall score or rating. This is a multi-step process that requires judgment on handling some of the unique features of ESG data. While materiality may seem intuitive, in practice it is quite hard to measure. Which sector classification should be used? What is the yardstick to evaluate materiality? How can the data be presented in a consistent and comparable manner?

To illustrate the construction of an ESG signal, we develop a methodology using Sustainalytics data. We concentrate on Europe because of its high security coverage. We evaluate a variety

of materiality maps, combining insights from multiple mappings to create an ESG map. To combine them, judgment is used to bring together disparate ESG signals, for instance, how to combine qualitative versus quantitative metrics or binary versus continuous metrics. We develop two weighting schemes: one for the individual items within each of the three ESG categories and another for the weights of E, S and G. Lastly, we create a yardstick against which to measure the performance of our signal.

The most challenging and interesting part of our work is the development of our own materiality map. Several features of this map are especially relevant to our analysis. First, all three components of ESG are considered for each sector. For many sectors, the relative importance of each component is similar. But for several, one or two of the components dominate. For example, we assign Real Estate a larger weight on Environmental metrics because buildings are the world’s biggest users of energy. In contrast, we assign a lower weight on Environmental metrics and much more emphasis on Governance for Financials. The heat map in Exhibit 7 shows the relative weightings; a deeper blue color for represents categories that receive a higher weight in our scoring system for each sector.

Exhibit 7: Varying the importance of E, S, and G by sector (darker = higher weighting).

Sector	Environmental	Social	Governance
Energy	Dark Blue	Light Blue	Dark Blue
Materials	Medium Blue	Medium Blue	Medium Blue
Industrials	Medium Blue	Medium Blue	Medium Blue
Consumer Discretionary	Medium Blue	Medium Blue	Medium Blue
Consumer Staples	Medium Blue	Medium Blue	Medium Blue
Healthcare	Medium Blue	Medium Blue	Medium Blue
Financials	Light Blue	Light Blue	Dark Blue
IT	Light Blue	Light Blue	Light Blue
Telecom	Light Blue	Dark Blue	Light Blue
Utilities	Dark Blue	Light Blue	Light Blue
Real Estate	Dark Blue	Light Blue	Light Blue

Exhibit 8: Backtested results for SSGA Proprietary ESG signal (January 2010 to December 2016, USD, Gross Returns MSCI World Universe).

	Top decile	Bottom decile	Spread
Forward 1-mth return	0.74%	0.75%	-0.01%
Forward 1-mth volatility	5.16%	4.25%	2.11%
Forward 3-mth return	2.36%	2.32%	0.05%
Forward 3-mth volatility	7.79%	6.94%	3.32%
Forward 6-mth return	5.12%	4.34%	0.78%
Forward 6-mth volatility	10.81%	9.27%	4.11%
Forward 9-mth return	7.76%	6.48%	1.28%
Forward 9-mth volatility	12.40%	10.86%	4.51%
Forward 12-mth return	9.94%	8.35%	1.59%
Forward 12-mth volatility	14.38%	12.24%	5.34%
Forward 24-mth return	17.45%	13.88%	3.57%
Forward 24-mth volatility	17.68%	14.18%	6.39%
Forward 36-mth return	29.84%	24.74%	5.10%
Forward 36-mth volatility	14.35%	12.90%	7.18%

Exhibit 8 shows backtested performance for our ESG signal using the same portfolio sorting method in earlier. Our ESG signal has positive performance over the historical August 2009 to March 2017 period. Focusing on the right materiality issues, the ESG can generate positive spreads for the longer term horizon. We believe that ESG is a red flag for firms that are either poorly managed or have a management team distracted by yet undisclosed issues. The biggest risk for these firms is an ESG-related scandal. But even if such a scandal does not materialize, the opportunity costs of a management team not focused on long-term growth is seldom insignificant.

For insight into whether ESG adds value after adjusting for other factors, we regress the returns on the Fama–French Three-Factor Model returns. If alpha is positive and statistically significant, this would suggest there is value-add in ESG. Exhibit 9 displays the results of the regression—the first column shows the intercepts from

Exhibit 9: ESG Alpha and statistical significance controlling for Fama–French factors (results of time series regressions, January 2010 to December 2016).

	Alpha	<i>p</i> Value
1 mth	-0.143	0.450
3 mths	0.120	0.738
6 mths	0.678	0.144
9 mths	0.748	0.104
12 mths	1.339	0.033***
24 mths	3.018	0.000***
36 mths	4.612	0.000***

the Fama–French regression for various holding horizons and the second column contains *p* values. For short horizons, alpha is not statistically significantly positive; however for longer horizons at 1 year and above, the alpha becomes large positive and statistically significant. In sum, our ESG signal has strong predictive power at longer horizons.

7 Conclusion

Growing data availability has created the opportunity to integrate ESG into equity portfolios in a comprehensive way. ESG is becoming a source of new and valuable information for investors, impacting both potential returns and risk. In this paper, we describe the challenges for equity portfolio managers, in particular the variation across data sources and empirical observation that ESG can be either additive or subtractive

from investment returns depending on the data source, type, and metric. We believe that ESG integration into the range of equity portfolios—indexing (passive), active fundamental, and active quantitative—is promising and potentially beneficial to investors if the modeling issues are treated properly. Our “blueprint” lays out a path for any investment manager seeking to understand how ESG fits into their investment process.

Appendix A: Details on the portfolio construction approaches

Exhibit A1: Definition for factors.

Attribute	Definition
Valuation	Price/Fundamental (fundamentals: earnings, cash flow, sales, dividend, and book value). All are normalized and then equally weighted
Volatility	Trailing 60-mth variance
Momentum	Trailing 12-mth return minus most recent 1-month return
Quality	Current ROA, earnings-per-share variability, long-term Debt/Equity. All are normalized and then equally weighted
Size	Free float market capitalization

Exhibit A2: Equity Core Beta strategy setup.

Strategy element	Setting
Benchmark and universe	MSCI World
Risk Model	Axioma Worldwide 2.1 Medium-horizon Fundamental Model
Objective Function	Maximize $f - \lambda \cdot \omega$ where f : ESG factor or inverse Carbon Footprint factor $\lambda = 2000$ ω : active variance
Country tilt bounds	+/-5% to benchmark
Sector tilt bounds	+/-5% to benchmark
Factor tilt bounds	None
Holding bounds	+/-2% (2.5% for grandthered holdings)
Limit buy/sell	20% of ADV (except for the portfolio initiation)
Rebalancing	Quarterly, end of March, June, September, December
Turnover limit	25% (two-way, quarterly)
Sample period	Sep 30, 2009 to March 31, 2017

Exhibit A3: Smart Beta Equity Core strategy setup.

Strategy element	Setting
Benchmark and universe	MSCI World
Risk Model	Axioma Worldwide 2.1 Medium-horizon Fundamental Model
Objective Function	Maximize $f - \lambda \cdot \omega$ where f : an equally weighted composite factor of valuation, low volatility, momentum, quality, size, and ESG (or inverse of Carbon Footprint) $\lambda = 100$ ω : active variance
Country tilt bounds	+/-5% to benchmark
Sector tilt bounds	+/-5% to benchmark
Factor tilt bounds	Valuation, low volatility, momentum, quality, size: [0.5, 1] ESG: [0.2, 0.5]
Holding bounds	+/-2% (2.5% for grandthered holdings)
Limit buy/sell	20% of ADV (except for the portfolio initiation)
Rebalancing	Quarterly, end of March, June, September, December
Turnover limit	25% (two-way, quarterly)
Sample period	Sep 30, 2009 to March 31, 2017

Notes

- ¹ The U.S. Supreme Court definition of material states that an omitted fact is material when “a substantial likelihood that the disclosure of the omitted fact would have been viewed by the reasonable investor as having significantly altered the ‘total mix’ of information made available.” TSC Industries, Inc. v. Northway, Inc. 426 U.S. 438 (1976).
- ² This Directive is part of the wider European Union’s initiative on Corporate Social Responsibility which includes plans for a consistent approach to reporting to support smart, sustainable and inclusive growth in pursuit of the Europe 2020 objectives.
- ³ We note that these results are in contrast to a recent paper by Nagy *et al.* (2016) which shows that there is significant return attached to MSCI’s ESG scores. There are several differences between our two empirical approaches ranging from portfolio construction to time period which we continue to reconcile.
- ⁴ The U.S. Supreme Court definition of material states that an omitted fact is material when “a substantial likelihood that the disclosure of the omitted fact would have been viewed by the reasonable investor as having significantly

altered the ‘total mix’ of information made available.” TSC Industries, Inc. v. Northway, Inc. 426 U.S. 438 (1976).

- ⁵ SASB has created an industry-specific materiality map that can be used by firms and investors to identify the material ESG metrics for use in financial disclosures. SASB’s framework leverages research conducted in 2010 in conjunction with the Initiative for Responsible Investment (IRI).

Acknowledgements

The authors would like to thank Rakhi Kumar, Chris McKnett and Mahesh Jayakumar for their feedback on this paper.

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Keywords: ESG; sustainability; equities; materiality; integration

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