Integrating ESG in Portfolio Construction

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Abstract

This study recommends an approach to integrate ESG into portfolios that is based on two premises. The first is that classifying firms into good and bad ESG companies should be performed using ESG items that are material in that industry. The second premise is that it is possible to overcome the sparse voluntary ESG data reported by firms by constructing an ESG Good Minus Bad (GMB) factor, and then finding those firms whose returns load significantly on this factor. We provide evidence that shows the superiority of using material industry-specific ESG items, and the merits of expanding the ESG classification using the ESG GMB loadings. Our approach is particularly suitable for quantitative investment approaches which invest in portfolios with large number of positions and many small active exposures, where vendor ESG data can be used in portfolio construction efficiently without the need to employ detailed ESG analyses of many individual firms. With such portfolios, it is less about the ESG classification of an individual company and all about the aggregate portfolio tilt towards good ESG and away from bad ESG at the portfolio level.

Integrating ESG in Portfolio Construction

Among the recent changes in the investment management landscape is the growing interest of investors and asset owners to do the right thing ensuring that companies improve their approach to Environmental, Social and Governance (ESG) issues. Incorporating ESG concerns into portfolio construction means that either the universe of investment candidates becomes more restricted, or that additional constraints are placed on the portfolios. Both restrictions may hurt short-term performance of the ESG portfolio in comparison to the non-ESG portfolios. Proponents of integrating ESG into their portfolios may do so because of their beliefs that long-term risks associated with poor ESG practices are not fully incorporated into market prices, leading to superior long-term risk-adjusted returns on the ESG portfolio. Alternatively, proponents of integrating ESG into portfolios may accept the costs of adding ESG constraints as the cost of doing the right thing, enjoying the non-monetary benefits of better ESG practices, such as leaving a better world for the next generations or improving living conditions for other people. Thus, an important challenge for investment managers is how to integrate ESG into their investment process while minimizing the potential costs imposed on portfolio construction due to ESG constraints. In this study, we suggest a quantitative investment approach to the integration of ESG into portfolio construction that should have negligible effects on the performance of the ESG portfolio as compared to non-ESG portfolios. We also propose a unique methodology to deal with one of the most important shortcomings of ESG data; prevalent missing data by companies that do not report relevant ESG items.

The related literature on ESG or Corporate Social Responsibility (CSR) provides ambiguous evidence about the performance of ESG portfolios. A strand of literature examines the benefits

of ESG in terms of the lower cost of capital (both debt and equity) experienced by companies with superior ESG scores as compared to those that have inferior ESG scores.[1] However, these results imply that if markets are efficient, and investors properly incorporate ESG into prices, future returns on better ESG firms should be **lower** than on inferior ESG firms. In fact, the literature on the performance of superior ESG firms as compared to inferior ESG firms does not provide clear-cut evidence in any direction. Some studies show outperformance by better ESG companies, some show underperformance, while others do not provide conclusive results one way or another.

A major shortcoming of studies on the effects of ESG is that ESG disclosures are voluntary, and there are no uniform standards to ensure comparability of those items across firms. Furthermore, there are several providers of ESG data, but studies that compare the rankings of firms from the various ESG providers show low correlations across them. Thus, not only are ESG data reported sparsely and sporadically by firms, but also the data collection and rankings of firms by providers of ESG data add noise to the process of incorporating ESG into portfolio construction.

The purpose of this study is two-fold. We first suggest an approach that limits reported ESG data items for a particular company to only those that are more relevant for that company's industry. We rely on an independent not-for-profit standard-setting ESG body that determines the material ESG items for each industry. In our back-test simulation (which is not reported in this study), the methodology yields comparable returns to those obtained on a non-ESG portfolio. Thus, we manage to reduce the expected costs of ESG implementation to practically zero, because our

[1] A detailed literature review is provided in the Appendix.

approach is based on taking small bets on many companies and replacing inferior ESG companies with better ones that have similar expected returns.[2]

The second purpose of this study is to suggest a methodology to identify firms which are either significantly superior or significantly inferior ESG companies, even when they do not report sufficient ESG data. The approach is similar to that used in pairs trading. We first create an ESG factor which is essentially a hedge portfolio of good ESG companies minus bad ESG companies. We then regress monthly returns of a particular company on the Fama-French factors plus the created ESG factor. Companies that load significantly positively (negatively) on the ESG factor are considered good (bad) ESG companies even if they have not disclosed sufficient ESG data.

We find that our approach to identification of better ESG firms using both the material ESG items and expansion into companies that are not reporting ESG items is superior to an approach that utilizes all ESG items. We find that companies with better ESG scores using our ESG approach have higher valuations (higher market to book ratios) than companies with worse ESG scores. In spite of these higher current valuations for companies with better ESG scores, our good ESG companies have returns that are statistically not different than those of poor ESG companies. This can be explained in part by investors' expectations of similar returns on good and bad ESG companies. Indeed, we find that financial analysts implied rates of returns (as measured by the ratio of target prices to current prices) on better ESG companies are statistically on par with those of inferior ESG scores, although their implied valuations (ratio of target price to book value) are higher for the better ESG companies.

[2] The identification of material items we advocate in the current study was used in another study by Kahn et al. (2016), who found ESG scores based on material items can lead to outperformance of good ESG companies.

Our study contributes to the literature along the following lines. It provides an innovative approach to identify companies with poor or superior ESG factors even when these companies do not disclose sufficient ESG data. It also provides a practical approach to portfolio construction which tilts towards better ESG companies, but one that is not expected to yield lower future returns.

2. Literature Review and Research Design

As summarized in the extensive literature review in the Appendix, prior studies provide conclusive evidence that firms with better ESG scores tend to have lower cost of capital and enjoy higher valuations than firms with inferior ESG scores. Better ESG firms are able to borrow at lower interest rates, have lower cost of equity capital and enjoy higher market to book (M/B) equity values or Tobin's Q. In contrast, prior studies are far from conclusive about whether better ESG firms enjoy future higher returns, with some studies documenting higher future returns for better ESG firms, some documenting lower returns and still others documenting no meaningful differences in returns. If indeed current valuations of better ESG firms are higher than those for companies with lower ESG scores, then their future returns should be lower than those of worse ESG firms, unless investors are less than completely rational in incorporating ESG into equity prices. Such mispricing can occur due to several specific reasons related to ESG. The reported ESG data is voluntary, is very sparse, and scoring of these data varies widely across the various ESG data vendors.

A recent approach to determine which ESG items are material for specific industries was implemented by the Sustainability Accounting Standards Board (SASB), a non-for-profit organization similar to the Financial Accounting Standards Board, the body that promulgates

accounting standards. SASB's mission statement is: "to maintain sustainability accounting standards that help public corporations disclose material, decision-useful information to investors in SEC filings. That mission is accomplished through a rigorous process that includes evidence-based research and broad, balanced stakeholder participation. The SASB, through its Foundation, also provides education and resources that advance use of the standards."[3] A recent study by Kahn et al. (2016) used a partial mapping of SASB material items in the then-available industries to document that better ESG firms enjoy superior future returns. In our study, we primarily utilize the now complete SASB material items to calculate ESG scores for firms, and compare these results against those obtained using all ESG items (material and not material alike).

2.1 Materiality Map

SASB creates a Materiality Map that maps a set of 30 issues to a set of 79 industries in 10 sectors according to its SICS (Sustainability Industry Classification System). They are guided by the definition of materiality as identified by the U.S. Supreme Court: information is material if there is "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." In order to determine materiality for sustainability issues, SASB employs analysts specialized in a particular industry to evaluate which sustainability metrics are material to that industry.

The analysts use three main criteria to determine which issues are material to that industry. First, the analysts look for evidence of interest. They examine public information from company filings like Form 10-K's, shareholder resolutions, CSR reports, public media and SEC comment

[3] https://www.sasb.org/sasb/vision-mission/

letters to assess how much attention is being paid to a particular sustainability issue. Second, the analysts look for evidence of financial impact. They look at sell-side research, investor call transcripts and third-party research to assess whether a sustainability issue is likely to impact financial performance. Finally, the analysts consider forward-looking impact. They make adjustments to the map for items that may create positive or negative externalities. This allows SASB to correct the imperfect state of current sustainability reporting by companies and in the media.

As is evident in Exhibit 1 for two industries, the sustainability issues considered material by SASB can be very different in each industry.

Exhibit 1: Material Items in 2 SICS Industries

Insurance	**Oil and Gas – Exploration and Production**
Customer welfare	GHG emissions
Fair marketing and advertising	Air quality
Lifecycle impacts of products and services	Water and wastewater management
Environmental, social impacts on assets & operations	Human rights and community relations
Systemic risk management	Employee health, safety and wellbeing
	Accident and safety management
	Business ethics and transparency of payments
	Regulatory capture and political influence
	Supply chain management

Source: SASB Materiality Map

2.2 Using ESG Data with the SASB Materiality Map

From the 30 ESG issues SASB identifies, we map each of them to one or more Bloomberg raw data items, for a total of 52 Bloomberg items.[4] We must also map each of the 79 SICS industries to one of 157 MSCI GICS sub-industries. The final mapping of Bloomberg raw ESG items to

[4] The remainder of this study uses ESG data from Bloomberg. We have replicated our analysis with ESG data from Thomson Reuters's Asset4. The results are qualitatively very similar.

GICS sub-industry results in an average of 11 material items in each sub-industry, out of a total of 52 items. Some sub-industries have as few as only one material item, and others have as many as 25 material items. A full listing of the number of material items is provided in Exhibit 2.

(Insert Exhibit 2 about here)

We can then categorize and create a numeric sub-score for each data item. The raw ESG data items fall into two broad categories: binary and numeric. Binary items consist of "Yes" or "No" responses from companies on a particular ESG issue. For example, whether a company has a Human Rights Policy is a binary ESG data item. In order to create a sub-score for binary items, we first identify the item as either positive or negative. Most binary items are policy-based and are considered positive, but there are also some negative binary items, such as a Product Recall Announcement. If the data point is "Yes" ("No"), we assign a +1 (-1) as the sub-score for the item. If the item is negative we reverse the sub-score, assigning a -1 (+1) for "Yes" ("No").

Numeric ESG items fall into two main groups. First, there are unscaled metrics such as CO_2 Emissions. Second, there are scaled metrics such as Employee Turnover Percentage and Percent of Waste Recycled. To improve comparability across stocks, we manually scale the unscaled metrics by company market capitalization. We use the scaled metrics as found in the data. Once all of the numeric items are scaled, we rank each item into two groups within its GICS industry, above and below median. If the data point is above (below) median on that date, we assign a +1 (-1) sub-score for the item. Similar to the binary items, if the item is negative we reverse the sub-score.

3. Data and Variables

The primary source of ESG data is from Bloomberg. We typically construct our ESG scores on December of each year, using data that is identified from the year before. For example, in December 2009, we use the 2008 ESG data, which presumably get disclosed sometime in 2009. We then examine stock performance in 2010. We purposely allow a longer time frame for ESG data in our analysis to be more conservative, since disclosure of ESG items is not mandated as financial data are by the SEC. For stock returns, we use the CRSP database. We use the buy-and-hold return on a stock from January through December (or earlier if it stopped trading during the year) minus the buy-and-hold return of similar stocks in terms of size (three groups), B/M (three groups) and 11-month momentum (three groups). For the analysis that involves using target prices by analysts, we use the IBES database. Fundamental data is from the Compustat Point-In-Time database.

To identify good and bad ESG firms, we first identify all the SASB material items that were disclosed for that firm. If there were at least six material items and at least half of them were positive, we classified the firm as a good ESG firm. If there were at least six material items but fewer than 20% were positive, we classified the firm as bad ESG firm. Firms that had fewer than six material items but disclosed at least one material item, or firms that had six material items but the percentage of the positive items fell between 20% and 50% were classified as neutral. All other firms were classified as missing. We follow identical classification using not only the material items, but all disclosed ESG items, to determine the benefits of using the SASB materiality mapping.

We begin our data analysis in December 2008 and repeat it through December 2015 for the universe of the (roughly) Russell 3000 companies. Naturally, we expect data availability to be better for the larger companies. We provide direct evidence consistent with this expectation for the S&P 500 constituents. As we argued earlier, an appealing feature of our approach is that we are able to identify firms whose stock returns behave similarly to those that we identified as good or bad firms, so we can construct ESG scores for firms that did not disclose ESG items or were not included in our initial sample.

Table 1 provides summary statistics on our initial Russell 3000 sample and on the S&P 500 firms. As can be seen from Panel A for the Russell 3000 universe, we had over 23,000 annual observations with market values and subsequent returns for the eight years we studied, or over 2,875 per year. However, the table reveals that only 7,766 annual observations, or roughly a third, were from companies with at least one reported material ESG item. In contrast, about two thirds of the firms had some ESG item disclosed if we do not impose the limitation of ESG materiality. On average, there are four times more ESG items than material ESG items. We observe a wide distribution of firm size, as can be expected from the Russell 3000 universe, and the B/M ratios are similar to those reported in prior studies. Finally, the average and median subsequent annual excess returns are close to zero, but positive, possibly reflecting superior returns over that period for the larger firms.[5]

Panel B of Table 1 reports similar data for the universe of the S&P 500 firms. A striking feature of these firms is the better ESG data availability; almost 80% have at least one reported material ESG item, and about 95% have at least one reported ESG item. However, similar to what we

[5] Throughout the study, excess returns refer to the buy and hold return of the stock minus the buy and hold value-weighted return of firms with similar size, B/M and momentum.

observed earlier, there are about four times more ESG items than material ESG items. Naturally, the S&P 500 firms are larger and have typically lower B/M ratios than the Russell 3000 firms in Panel A.

(Insert Table 1 about here)

4. ESG Scores and Future Returns

Table 2 provides the average annual abnormal returns on firms that were classified as good, bad, neutral, or missing according to both the material (SASB) ESG items (columns 1 and 2) and all ESG items (columns 3 and 4) for the Russell 3000 universe shown in Panel A. The good companies according to the material ESG items had an average excess return of 1.7% during the following year after portfolio construction, whereas the bad companies had an average negative excess return of -1.4%. However, a t-test of the difference in excess returns between these two groups did not reject the null hypothesis that these two groups had in fact equal excess returns. We further show that the firms with neutral scores on ESG had an even higher average excess return of 4.5%, and the majority of firms that reported no material ESG items (about two thirds of the observations) had a negligible excess return of 50BP[6]. From column 2, it is evident that our classification of good and bad ESG firms according to the SASB material items yields a very small percentage of the population, about 1.4% and 2%, respectively, emphasizing the need to expand our classification of good and bad firms to non-reporters as well.

A different picture emerges when we examine the classification of firms as good and bad ESG companies using all available ESG items (columns 3 and 4). The good ESG companies

[6] The mean excess return for the Russell 3000 universe is slightly positive because the peer companies in the same size, B/M and momentum companies are based on the entire CRSP database.

underperformed the bad ESG companies with average excess returns of 3.8% and 4.6%, respectively, again not statistically different from each other, with the neutral group having a similar excess return of 4.8%. Firms that have no ESG data at all had an average negative excess return of -4.2%. Note that using all ESG items, although providing higher returns for bad ESG companies, actually allow a higher percentage of companies to be classified as good and bad with 4.6% and 16%, respectively.

(Insert Table 2 about here)

Panel B of Table 2 reports similar data for the universe of S&P 500 companies. In contrast to Panel A, there are many fewer companies that do not report any material ESG items (less than 20% of the observations). As before, good material ESG companies outperform bad ESG companies with excess returns of 1.3% and -10BP, respectively, but with neutral companies now having an average excess return of 4.1%. The percentage of companies classified as good and bad ESG companies is 3% and 10%, respectively, again stressing the need to expand into firms that do not report sufficient number of material ESG items. Similarly, when we use all ESG items, the bad ESG companies outperform the good ones with average excess returns of 4.5% and 3.5%, respectively, but here we are able to cover more than half of the S&P 500 constituents. Very few companies (less than 5% of the S&P 500 constituents) do not report any ESG item.

5. Expanding the ESG Classification

As we saw earlier, the proportion of firms that do not report sufficient number of material ESG items is quite large. To expand the ESG classification to those firms, we follow a procedure that is similar to the one used in pairs trading. We first create each December an ESG Good Minus Bad (GMB) factor, which is the value-weighted return of the good ESG companies according to

the SASB material items minus the value-weighted return of the bad ESG companies.[7] We then run an OLS regression of the return of each specific firm (minus the risk-free rate) on the five Fama-French factors (obtained from the Kenneth French data library), plus the ESG GMB factor. This regression uses 60 monthly returns from the prior five years. Firms with positive loadings on the ESG GMB factor are considered good ESG companies, and firms with negative loadings on the ESG GMB factor are considered bad ESG companies. While we can use the ESG GMB factor loadings to rank companies according to how similar their returns are to the ESG GMB factor, it may make more sense to use the t-statistics of the factor loadings, and just use those firms whose loadings are significant.

Table 3 presents summary statistics for the firms that had significant negative loadings (classified as similar to bad ESG companies) in Panel A, and significant positive loadings (good ESG) in Panel B. The t-statistics of the loadings in Panel A and B are all above two (in absolute value) with all negative in Panel A and positive in Panel B, which is of course true by design. In Panel A, the number of observations with ESG scores based on material items is 625, which should be compared to 2,131 observations based on the ESG GMB loadings. This represents an increase of about 240% in the number of observations that can be classified in spite of many firms not reporting at least six material items. Similarly, the increase in Panel B is from 510 to 1,561, an increase of 206%. Thus, we find a significant improvement in the number of companies that can be classified as good or bad ESG companies, in spite of insufficient reporting of material items. Ideally, for those that have an actual ESG score in either of the two groups, we should see that the scores are related to their loadings on the GMB ESG factor. Indeed, as is

[7] The ESG GMB factor has an average return of about -9BP per month, consistent with no significant return differences between the good and bad ESG firms.

evident in the Table, the group of firms with positive loadings in Panel B has a larger average score of 0.34 than those with negative loadings in Panel A of 0.26 (significantly different at the 0.0001 level).

(Insert Table 3 about here)

In terms of their subsequent annual excess return, bad ESG companies have average excess returns of -3.2% (in Panel A) whereas the good ESG companies have an average positive excess return of 2.7% (with the two groups' means significantly different at the 0.0021 level). Although these results seem to indicate better performance of good ESG companies over the entire eight years covered in our sample, when we compare the performance of good and bad ESG firms annually, we find that in three years bad ESG firms actually outperform good ESG companies, and in another year the returns were not statistically different between the two groups. The seeming outperformance of the good ESG firms for the entire sample period is due just to two years in which good ESG firms significantly dominated the bad ESG firms. Thus, although we show statistically better performance for good ESG firms during the entire eight-year period 2009-2016, the year-by-year results do not indicate consistency of such outperformance. We interpret these results as similar performance for the two groups. Still, these results show the potential of using the expanded universe, where more observations can be classified into the good and bad ESG groups with performance that is in line with those companies with valid ESG data. Ideally, though, active engagement with firms will yield widespread reporting of material ESG items.

To corroborate prior evidence of higher valuations of good ESG companies, Table 3 provides information on the average B/M ratios of bad companies, which is 1.42 (median of 0.66),

significantly higher than those of good ESG companies at 0.79 (median 0.60, significance level that the two groups have different means is 0.0678). Thus, there are clearly benefits for firms to engage and disclose positive material ESG initiatives, as such firms enjoy higher valuations (higher M/B ratios). However, if current valuations of good ESG firms are higher, why do they also not have lower future excess returns? This is similar to observations about quality, where good-quality companies enjoy both higher current valuations and also higher future returns. To explain this phenomenon, Asness et al. (2013) posit evidence of mispricing by examining the way security analysts value quality firms. Following a similar approach, we obtain the average 12-months target price by all analysts in the 90 days before portfolio formation, and the average implied rate of return in their target price, dividing the target price by the security price on the day before the target price was announced. We can now examine if security analysts value good ESG firms more highly than bad ESG firms, and second whether they simultaneously expect their future returns to be lower.

We obtain target prices from IBES. Because the bad ESG firms are generally smaller than the good ESG firms (median market values of $729 million and $1.005 billion, respectively in Table 3), the percentage of firms with target prices coverage is higher among the good ESG companies. Examining security analysts' average valuations by comparing the ratio of book value per share to average target price (B/M), we find that bad ESG firms had an average B/M ratio of 0.84 whereas good ESG firms had an average B/M ratio of 0.61, with the bad ESG firms having a higher B/M ratio (or lower valuations) at a significance level of 0.0907. Simultaneously, security analysts expect the average return on bad ESG firms to be higher than those of good ESG firms, 33% and 21%, respectively, which is consistent with their higher valuations of good ESG firms. However, the seemingly higher implied returns for bad ESG firms are insignificantly different

from good ESG firms at a level of 0.1642. Thus, while security analysts price good ESG firms at higher valuations than bad ESG firms, they misprice their future returns somewhat by expecting them to enjoy similar returns to those of bad ESG firms. This is consistent with the above results of good ESG companies enjoying higher market valuations but overall future stock performance that is comparable to that of bad ESG companies.

In an attempt to better understand the companies that were assigned good or bad ESG scores using the loadings on the ESG GMB factor, we examined whether there are any industry concentrations in each of the two groups of significant loadings. We found that utilities and some financials (like banks, insurance and mortgage REITs) had a larger proportion of good ESG companies. In contrast, the energy sector, some industrial companies in marine and road & rails, REITs, and metals & mining companies had a higher percentage of bad ESG scores. This seems to be intuitive, and raises our confidence about the proposed methodology of assigning firms to good and bad ESG groups based on how close their returns are to known good and bad ESG firms.

To complete the picture, Table 4 presents summary statistics similar to Table 3, but with all ESG disclosed items, not only the material SASB ESG items. We follow the same procedure as before, creating a GMB factor using all ESG items, and using only firms with significant loadings. In Table 4, there are more firms classified as bad ESG companies when using all items, 2,900 observations as compared to the 2,131 in Table 3, but fewer good ESG companies, with 1,403 observations in Table 4 against 1,561 in Table 3, where only material ESG items were used. Also, contrary to Table 3, the median market value of bad ESG firms is actually higher than that of good ESG firms. An examination of the subsequent annual excess return shows that bad ESG firms had an average of 2.9%, greater than the average for good ESG firms of 1.4%,

statistically indistinguishable from each other (significance level 0.3605). The average (median) B/M ratio of good ESG firms is 0.80 (0.63) which is lower (equal) to that of bad ESG firms 1.23 (0.62), statistically indistinguishably different from each other at the 0.2019 significance level. Thus, contrary to our earlier findings where only material SASB ESG items were used, good ESG firms using all ESG items do not have higher valuations, nor do they enjoy higher subsequent excess returns. Consistent with that, we find that security analysts do not place a higher valuation on good ESG firms, nor is their implied rate of return different from bad ESG firms. These results show the advantage of using the SASB material items in combination with our expanded universe in the classification of good versus bad ESG companies.

(Insert Table 4 about here)

5.1 Robustness Tests

Our study was conducted using Bloomberg ESG data. In their study of the material ESG items according to SASB, Kahn et al. (2016) used KLD data. To ensure that our results were not due to the specific data vendor we use, we repeated the analysis using the Asset4 data, with similar results. Using the material ESG data items in the Asset4 database provided superior results to using all items. Similarly, expanding coverage using the return-based approach yielded similar results to those reported above.

To gain confidence in our ESG GMB factor and its results, we used an alternative mechanism to construct a GMB factor. We identified all products on the eVestment database that were self-designated as responsible or ESG strategies.[8] We then calculated the value-weighted monthly returns on this portfolio of products, where the value is the assets under management of the

[8] We only used domestic funds that had at least $25 million in assets under management.

product. This value-weighted return represented the good part of the factor, and the remainder of the market return represented the bad part. This approach to expand the classification of companies with missing ESG data yielded results that were similar to those we report above.

6. Conclusions

This study provides two major contributions to the efforts of integrating ESG into portfolio construction in a way that will not detract from performance, and will include firms that do not disclose sufficient data about ESG. We provide evidence that using only material ESG items in each industry is preferable to using all disclosed ESG items. We further show that it is possible to expand the classification of non-ESG-reporting firms into good and bad ESG groups using a construction of an ESG GMB factor and the loadings of non-reporting firms on this factor. This expansion allows us to increase the number of good and bad companies by over 200% while preserving the characteristics and return patterns of the original good and bad ESG firms. Finally, we argue that quantitative investment processes with large number of positions and small active exposures can most efficiently incorporate the sparse ESG data in their portfolio construction. Using our methodology for such portfolios will ensure that the aggregate portfolio is tilted towards good ESG firms and away from bad ESG firms, without the need to be completely accurate about the ESG classification of each individual company.

Appendix 1 – Literature Review

The literature on Environmental, Social, and Governance (ESG) issues is extensive, but far from conclusive. The only area of agreement in the literature is about the positive effects of ESG on the cost of capital; companies with better ESG scores tend to be able to borrow more cheaply, have higher credit rankings and lower cost of equity capital. We will review this literature first.

Cost of Capital:

Bauer and Hann (2010) investigate more than 2,200 bond issues in the U.S. and rely on KLD scores as their main data source for Corporate Social Responsibility (CSR) ratings. They find that companies with better environmental management standards have lower loan spreads. Similarly, Chava (2011) investigates 5,879 loan facilities made to 1,341 US-based firms and finds that corporations with several environmental concerns have to pay significantly higher interest rates on their loans. Goss and Roberts (2011) report that firms with CSR concerns pay on average between 7 and 18 basis points more on their loans than firms with no CSR concerns. They attribute it to banks view of CSR concerns as risk factors. Similarly, Schneider (2011) concludes that poor environmental performance presents a significant downside risk in future cleanup and compliance costs. These costs can be so large to threaten the ability of polluting firms to meet their fixed payments to creditors.

Earlier work focused on the effects of governance on the cost of debt financing. Bhojraj and Sengupta (2003) document that a higher percentage of institutional ownership and outside directors is positively correlated with higher bond ratings and lower bond yields. Klock, Mansi and Maxwell (2005) as well as Ashbaugh-Skaife, Collins and LaFond (2006) show that corporations with anti-takeover provisions in place have negative and significant effects on bond

yields. Cremers, Nair and Wei (2007) document that institutional ownership can lower the yields on outstanding corporate bonds. Bradley, Chen, Dallas and Snyderwine (2008) construct a governance index which uses board stability and discretion; this index is shown to be positively related to credit ratings. Chava, Livdan and Purnaanandam (2009) show that firms that have fewer antitakeover devices in place pay on average significantly higher spreads on bank loans.

It is typically more challenging to show convincingly the effects of factors on the cost of equity capital than on debt capital. Nonetheless, several studies have documented the positive effects of ESG on the cost of equity capital. Ashbaugh-Skaife, Collins and LaFond (2004) find that well-governed firms exhibit a cost of equity financing which is 136 BP (or 88 BP on a risk-adjusted basis) lower compared to poorly-governed counterparts. Derwall and Verwijmeren (2007) find that better corporate governance leads to lower cost of equity capital over the period from 2003 to 2005. Ghoul, Guedhami, Kwok and Mishra (2011) find that firms with better CSR quality exhibit lower cost of equity financing for a large sample of US firms. This result is driven by specific sub-categories of CSR; the firm's quality of employee relations, its environmental management quality, and its product quality. Sharfman and Fernando (2008) find that firms with better environmental risk management exhibit significantly lower cost of equity capital. Dhaliwal et al. (2011) report a reduction of 1.8% in the cost of equity capital for first-time CSR disclosing firms with excellent CSR quality. Albuquerque, Durnev and Koskinen (2013) investigate both theoretically and empirically the indirect influence of CSR on the cost of equity through the firm's Beta. They find that their CSR index is significantly and negatively correlated with a firm's Beta, which implies a lower cost of equity financing.

Summing up this section, the literature is clear-cut; better ESG companies have lower costs of debt and equity financing. There seem to be clear benefits for firms to improve their ESG scores given the potential benefits in reducing capital costs.

ESG and Valuation:

Given that better ESG companies have lower financing costs, it is expected that they would also enjoy higher valuations. This indeed is typically what past studies find. Konar and Cohen (2001) show that both the release of toxic chemicals and the number of environmental lawsuits are significantly and negatively related to Tobin's Q. Jiao (2010) argues that corporate environmental performance is the driving force behind the positive relation between stakeholder welfare (such as employees, customers, communities) and Tobin's Q. Derwall, Bauer and Koedijk (2011) indicate that a firm's Tobin's Q is positively and significantly influenced by its eco-efficiency, even after controlling for firm characteristics. Baron, Harjoto and Jo (2011) find that social pressure (measured by KLD concerns) is negatively correlated with Tobin's Q for a large sample, but not with the KLD indictors themselves. Deng, Kang and Low (2013) study 1,556 completed U.S. mergers between 1992 and 2007, and find that acquirers with CSR qualities create value for both acquiring and target shareholders. Hawn and Ioannou (2013) show that symbolic CSR changes significantly increase Tobin's Q. In contrast, Jayachandran, Kalaignanam and Eilert (2013) find that product social performance is associated with higher Tobin's Q, but environmental performance is not. Thus, most studies document a positive relationship between ESG scores and firm valuation; better ESG firms enjoy higher valuations.

ESG and Future Returns:

Assuming that better ESG firms enjoy higher current valuations, it is expected that their future returns should be lower, unless investors are not incorporating the higher current valuations into future returns. The oldest line of ESG research compares the performance of conventional and Socially Responsible Investment (SRI) funds. Bauer et al. (2005) find that SRI funds and conventional funds differ in terms of style but produce similar alphas. SRI funds delivered lower alphas in the early 1990s but then caught up with conventional funds. Barnett and Salomon (2006) find that losses due to poor diversification of SRI funds are offset by better security selection as screening intensifies. Renneboog et al. (2008) find that European and Asian SRI funds, mainly internationally oriented, underperform domestic factor models, but SRI funds do not underperform conventional funds in most countries. Utz and Wimmer (2014) argue that SRI mutual funds do not, on average, hold socially responsible firms to a greater extent than conventional funds, and question whether we can learn from SRI funds anything about ESG investing. In addition to SRI funds, a number of papers, such as Sauer (1997), Statman (2000), Schröder (2004), Statman (2006), Schröder (2007) and Lee and Faff (2009), find the performance of SRI indices comparable to conventional indices. Belghitar, Clark and Deshmukh (2014) find that there is no difference regarding the expected returns and variance between SRI and conventional indices. However, socially responsible investors pay a high price in terms of utility if higher moments are taken into account.

If there are sufficient number of investors who prefer good ESG companies and shun bad ESG firms, the expected returns of the latter should actually be higher. Indeed, Angel and Rivoli (1997) predict that a socially controversial stock that investors shun has a higher expected return, and that the expected return increases with the proportion of socially responsible investors in the

market. Heinkel et al. (2001) find that shareholders of controversial companies receive compensation for holding more shares of environmentally controversial firms than they would if the market was free of boycotts. Brammer, Brooks and Pavelin (2006) demonstrate that for UK companies, firms with good CSR ratings tend to underperform in relation to their poor CSR counterparts and they attribute this finding to the environmental indicators driving this finding. Salaber (2007) finds that a portfolio that comprises European sin stocks outperform a ‘‘sin-free’’ portfolio over the period 1975–2006 by more than 4% annually. Fabozzi et al. (2008) find that controversial industries earn relatively high returns in many countries around the world. Hong and Kacperczyk (2009) find that sin stocks of international markets outperform by 2.5% per year over the period 1985–2006.

In contrast to these studies, the literature has examples of studies that show higher returns for better ESG companies. Van de Velde et al. (2005) use CSR ratings from the French research firm Vigeo to test SRI portfolios in the European Monetary Union (EMU) area for the period 2000–2004. Their results indicate that high-CSR-rated portfolios perform better than low-rated portfolios, but not significantly so. Derwall et al. (2005) use ‘‘eco-efficiency scores’’ to evaluate equity portfolios. They report that a best-in-class portfolio that contains the top 30% of U.S. stocks with the highest eco-efficiency scores relative to industry peers delivers a four-factor alpha of 4.15% per year over the period 1995–2003. In contrast, a portfolio of firms with the lowest scores produces a negative but insignificant alpha of minus 1.8%. Kempf and Osthoff (2007) compare the performance of high- and low-rated ESG companies during 1992-2004. They find the Carhart (1997) four-factor model reveals a significant performance difference of up to 8.7% per year between high and low ESG firms. Statman and Glushkov (2009) and Lee, Faff and Rekker (2013) find similar results. Eccles, Ioannou and Serafeim (2014) follow a combined

approach (using data from several sources, including their own) to identify high and low sustainability firms from a sample of 180 U.S. companies. They also find annual abnormal returns of up to 4.8% for the better ESG firms.

There are also a few studies that are unable to show superior returns either for better or for worse ESG companies. Gerhard et al. (2015) find no significant return differences between companies featuring high and low ESG rating levels. This is a particularly comprehensive study because it uses different ESG databases and provides recent performance. Indeed, Dorfleitner, Halbritter, and Nguyen (2014) reveal significant differences in distribution, level and risk of various ESG rating vendors. Manescu (2011) also is unable to show that ESG ratings can affect stock performance.

To summarize the above findings (or non-findings), there is no clear-cut evidence that good ESG firms earn higher returns, or also for that matter that good ESG firms earn lower returns. It is probably safer to assume that good ESG firms may have lower cost of capital, higher valuations, but at best comparable future returns to bad ESG firms.

ESG and Accounting Performance:

Firms that engage in pure ESG activities incur costs in doing so. Some of these activities are expected to also produce future benefits. For example, investing in improving water utilization is good for the environment, but will also lead to lower future costs. Whether the benefits from ESG investments exceed costs is a question that investors need to address. One way to answer this question is to examine various accounting performance metrics that do not involve stock prices. In that spirit, Russo and Fouts (1997) find a positive and significant relation between environmental and the firm's return-on-assets ratio. Orlitzky et al. (2003) conclude that both

social and environmental responsibility pay off in financial terms, but further argue that CSR seems to be more strongly related to accounting-based performance measures than market-based performance proxies. De et al. (2010) find that overall ESG scores have a positive association with both subsequent stock returns and return on equity (ROE) even after controlling for sector effects. They also find ESG factors have stronger predictive power in the mid- and small-cap range. Similarly, Derwall, Bauer and Koedijk (2011) indicate that better eco-efficiency significantly increases corporations' operating performance, measured by their return-on-assets. Kim et al. (2012) find that socially responsible firms are less likely to manage earnings through discretionary accruals, to manipulate real operating activities, or to be the subject of SEC investigations. Their findings also suggest that ethical concerns are likely to drive managers to produce high quality financial reports. Harrison et al. (2012) find that Goodness spending is much more sensitive to financial slack than is the case for capital and R&D expenditures and firms make more goodness expenditures when they are more profitable. Elroy et al. (2013) find that corporate social responsibility engagements that address ESG concerns are followed by a one-year abnormal return that averages 1.8%, comprising of 4.4% for successful and zero for unsuccessful engagements. After successful engagements, companies experience improvements in operating performance, profitability, efficiency and governance.

In summary, it seems that there is a positive association between ESG ratings and firms' accounting measures, mostly those related to profitability. One caveat to remember is that ESG expenditures and disclosures are voluntary. It is well known that profitable firms are more likely to voluntarily disclose more information and they are also in a better financial position to afford spending on ESG-related activities. This casts some doubts on the direction of causality.

Ratings based on Material ESG Factors:

One of the issues confronting a user of ESG disclosures is the large number of items that are available by most vendors. For example, Asset4 has more than 500 items that it tracks. Needless to say, not every company reports all of these items. Furthermore, not all items are equally relevant for each firm. It is intuitively appealing that some ESG items are important for one industry but largely irrelevant for another. CO_2 emissions may be relevant for utilities, but largely irrelevant for financial companies. A relatively new not-for-profit organization was founded in 2011 to determine which ESG items are the most relevant for each industry. This body is Sustainability Accounting Standards Board (SASB). Similar to its namesake, the Financial Accounting Standards Board which promulgates accounting rules, SASB determines the ESG items that are material to each industry after consulting with industry experts, investors and analysts. SASB has now completed a mapping of material ESG items in each industry, or sometimes sub-industries.

Using those SASB material ESG items that were available at the time of their study, Khan et al. (2016) find that firms with better material ESG ratings have superior future stock returns. Similarly, Grewal et al. (2016) find that shareholders proposals for disclosures of material ESG items lead to future improvements in market to book ratios, whereas those that are for disclosures that are not material do not.

These two studies show the importance of using a targeted approach to rating ESG practices of companies that is based only on material items for that industry.

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Table 1

Summary Statistics

Panel A: Summary Statistics for Russell 3000								
Variable	**N**	**Mean**	**Std Dev**	**10th Pctl**	**25th Pctl**	**50th Pctl**	**75th Pctl**	**90th Pctl**
Number of material ESG Items	20955	1.439	2.550	0.000	0.000	0.000	2.000	5.000
Number of ESG items	23007	5.767	7.399	0.000	0.000	1.000	13.000	14.000
Material ESG score	7766	0.304	0.308	0.000	0.000	0.250	0.500	0.750
ESG score - All items	15445	0.283	0.335	0.000	0.000	0.154	0.444	1.000
Future annual excess return	23007	0.017	0.490	-0.453	-0.199	0.002	0.203	0.465
Market value ($mil.)	23007	5867	21569	179	353	1018	3310	11074
Book/Market	22999	0.631	2.070	0.120	0.271	0.499	0.823	1.225

Panel B: Summary Statistics for S&P 500								
Variable	**N**	**Mean**	**Std Dev**	**10th Pctl**	**25th Pctl**	**50th Pctl**	**75th Pctl**	**90th Pctl**
Number of material ESG Items	3419	4.436	3.542	0.000	2.000	4.000	6.000	9.000
Number of ESG items	3871	15.691	6.198	12.000	13.000	14.000	19.000	24.000
Material ESG score	3037	0.387	0.290	0.000	0.143	0.400	0.600	0.750
ESG score - All items	3694	0.347	0.203	0.083	0.154	0.333	0.500	0.619
Future annual excess return	3871	0.041	0.311	-0.265	-0.115	0.028	0.173	0.338
Market value ($mil.)	3871	27536	46604	3981	6805	12638	26420	60163
Book/Market	3871	0.517	0.549	0.128	0.234	0.395	0.654	1.014

Source: Bloomberg ESG data, CRSP database, Compustat Point-In-Time database, Russell 3000 Index, S&P 500 Index, SASB.

Notes:

1. The table reports summary statistics for all observations on the portfolio formation dates of December 2008-2015.

2. Number of material ESG items is the number of SASB material ESG items reported for that observation. Number of ESG items is for all reported ESG items.

3. Material (all items) score is the percentage of all positive SASB material (all) ESG items.

4. Future annual excess returns are buy and hold returns on the stock minus the value weighted return on similar stocks in terms of size, B/M and momentum. It is calculated throughout the calendar year after December.

5. Market value of equity is in millions of dollars.

6. Book/Market is the ratio of book value of equity to market value of equity at the end of December.

Table 2: Mean Future Annual Excess Returns

Panel A: Russell 3000				
	SASB material items		All ESG items	
	Mean	N	Mean	N
Good ESG	0.017	482	0.038	1069
Bad ESG	-0.014	334	0.046	3777
Neutral ESG	0.045	6950	0.048	10599
Missing	0.005	15241	-0.042	7562

Panel B: S&P 500				
	SASB material items		All ESG items	
	Mean	N	Mean	N
Good ESG	0.013	392	0.035	859
Bad ESG	-0.001	113	0.045	1121
Neutral ESG	0.041	2532	0.037	1714
Missing	0.059	834	0.074	177

Source: Bloomberg ESG data, CRSP database, SASB, Russell 3000 Index, S&P 500 Index.

Notes:

1. The table reports average annual excess returns in the year immediately following the portfolio formation, which occurs every December 2008-2015. Excess returns are buy and hold returns on the stock minus the value weighted return on similar stocks in terms of size, B/M and momentum.

2. Panel A shows the results for the Russell 3000 universe, and Panel B for constituents of the S&P 500.

3. Good (Bad) ESG firm observations had at least six material items in the SASB material items column and six ESG items in the All ESG items, with average score of at least 0.5 (less than 0.2). Neutral ESG observations are those with at least six ESG items but score in the range of [0.2, 0.5], or fewer than six material items. Missing are all observations without ESG items.

Table 3

Summary Statistics - Analysis Based on SASB Material Items								
Panel A; Observations with significant negative loadings on ESG GMB								
Variable	**N**	**Mean**	**Std Dev**	**10th Pctl**	**25th Pctl**	**50th Pctl**	**75th Pctl**	**90th Pctl**
t-statistic	2131	-2.496	0.482	-3.184	-2.721	-2.370	-2.131	-2.018
Future annual excess return	2131	-0.032	0.653	-0.604	-0.285	-0.042	0.195	0.536
Material ESG score	625	0.257	0.276	0.000	0.000	0.200	0.500	0.667
ESG score - All items	896	0.238	0.257	0.000	0.077	0.154	0.351	0.556
Book/Market ratio	2131	1.425	13.721	0.194	0.359	0.662	1.155	2.080
Analysts' average B/M	1497	0.836	4.638	0.150	0.282	0.476	0.777	1.206
Analysts' average implied return	1497	1.334	2.299	1.022	1.091	1.172	1.305	1.571
Market value ($mil.)	2131	5002	19678	24	91	729	3609	11098

Panel B; Observations with significant positive loadings on ESG GMB								
Variable	**N**	**Mean**	**Std Dev**	**10th Pctl**	**25th Pctl**	**50th Pctl**	**75th Pctl**	**90th Pctl**
t-statistic	1561	2.535	0.523	2.040	2.158	2.374	2.764	3.276
Future annual excess return	1561	0.027	0.441	-0.338	-0.126	0.022	0.180	0.399
Material ESG score	510	0.339	0.302	0.000	0.000	0.333	0.500	0.750
ESG score - All items	944	0.331	0.343	0.000	0.000	0.214	0.524	1.000
Book/Market ratio	1561	0.789	0.956	0.201	0.381	0.602	0.888	1.325
Analysts' average B/M	1237	0.612	0.532	0.176	0.321	0.531	0.770	1.063
Analysts' average implied return	1237	1.211	2.281	0.994	1.045	1.101	1.189	1.328
Market value ($mil.)	1561	10220	35573	111	298	1005	4041	18164

Source: Bloomberg ESG data, CRSP database, Compustat Point-In-Time database, SASB, IBES.

Notes:

1. The table reports summary statistics on all observations classified as bad and good ESG firms using significant loadings on the ESG Good Minus Bad (GMB) factor. The factor is the value weighted return on good ESG firms according to SASB material items minus that of bad ESG firms. Good and bad ESG firms are as described in footnotes to Table 2. Loadings are estimated through a regression of the firm's 60 monthly returns on the Fama-French factors, plus the ESG GMB factor.

2. Future annual excess returns are buy and hold returns on the stock minus the value weighted return on similar stocks in terms of size, B/M and momentum. It is calculated throughout the calendar year after December.

3. Material (all items) score is the percentage of all positive SASB material (all) ESG items.

4. Book/Market (B/M) is the ratio of book value of equity to market value of equity at the end of December.

5. Analysts' average B/M is the average book value of equity per share divided by the 12-month price target, calculated over the 90-day period ending at the end of December. Analysts' average implied return is the 90-day average of 12-month target price divided by the price on the day prior to the target price announcement.

6. Market value is in millions of dollars.

Table 4

Source: Bloomberg ESG data, CRSP database, Compustat Point-In-Time database, SASB, IBES.

Summary Statistics - Analysis Based on All ESG Items

Observations with significant negative loadings on ESG GMB

Variable	N	Mean	Std Dev	10th Pctl	25th Pctl	50th Pctl	75th Pctl	90th Pctl
t-statistic	2900	-2.720	0.718	-3.723	-3.042	-2.509	-2.189	-2.047
Future annual excess return	2900	0.029	0.548	-0.457	-0.205	0.002	0.211	0.485
Material ESG score	918	0.268	0.314	0.000	0.000	0.200	0.500	0.750
ESG score - All items	1410	0.282	0.313	0.000	0.071	0.154	0.412	1.000
Book/Market ratio	2900	1.230	12.489	0.193	0.355	0.623	1.035	1.689
Analysts' average B/M	2127	0.605	0.568	0.153	0.282	0.476	0.764	1.098
Analysts' average implied return	2127	1.294	2.575	1.026	1.083	1.146	1.240	1.422
Market value ($mil.)	2900	4618	13312	32	119	937	3595	10431

Observations with significant positive loadings on ESG GMB

Variable	N	Mean	Std Dev	10th Pctl	25th Pctl	50th Pctl	75th Pctl	90th Pctl
t-statistic	1403	2.532	0.552	2.022	2.137	2.357	2.748	3.248
Future annual excess return	1403	0.014	0.421	-0.402	-0.171	0.004	0.159	0.393
Material ESG score	344	0.328	0.312	0.000	0.000	0.250	0.500	0.750
ESG score - All items	791	0.313	0.369	0.000	0.000	0.154	0.550	1.000
Book/Market ratio	1403	0.804	0.887	0.208	0.372	0.627	0.936	1.360
Analysts' average B/M	1053	0.605	0.591	0.175	0.297	0.512	0.752	1.044
Analysts' average implied return	1053	1.195	0.319	1.003	1.064	1.134	1.237	1.429
Market value ($mil.)	1403	11713	44496	97	258	626	2004	17893

Notes:

1. The table reports summary statistics on all observations classified as bad and good ESG firms using significant loadings on the ESG Good Minus Bad (GMB) factor. The factor is the value weighted return on good ESG firms according to all available ESG items minus that of bad ESG firms. Good and bad ESG firms are as described in footnotes to Table 2. Loadings are estimated through a regression of the firm's 60 monthly returns on the Fama-French factors, plus the ESG GMB factor.

2. Future annual excess returns are buy and hold returns on the stock minus the value weighted return on similar stocks in terms of size, B/M and momentum. It is calculated throughout the calendar year after December.

3. Material (all items) score is the percentage of all positive SASB material (all) ESG items.

4. B/M is the ratio of book value of equity to market value of equity at the end of December.

5. Analysts' average B/M is the average book value of equity per share divided by the 12-month price target, calculated over the 90-day period ending at the end of December. Analysts' average implied return is the 90-day average of 12-month target price divided by the price on the day prior to the target price announcement.

Exhibit 2: Number of material items in each sub-industry

sector	industry	subind	N Matl Items
Consumer Discretionary	Auto Components	Auto Parts & Equipment	8
		Tires & Rubber	8
	Automobiles	Automobile Manufacturers	5
		Motorcycle Manufacturers	5
	Distributors	Distributors	17
	Diversified Consumer Services	Education Services	7
		Specialized Consumer Services	7
	Hotels Restaurants & Leisure	Casinos & Gaming	10
		Hotels Resorts & Cruise Lines	10
		Leisure Facilities	8
		Restaurants	15
	Household Durables	Consumer Electronics	10
		Home Furnishings	10
		Homebuilding	8
		Household Appliances	1
		Housewares & Specialties	7
	Internet & Direct Marketing Retail	Internet & Direct Marketing Retail	11
	Leisure Products	Leisure Products	17
	Media	Advertising	4
		Broadcasting	5
		Cable & Satellite	8
		Movies & Entertainment	5
		Publishing	5
	Multiline Retail	Department Stores	17
		General Merchandise Stores	17
	Specialty Retail	Apparel Retail	17

		Automotive Retail	17
		Computer & Electronics Retail	17
		Home Improvement Retail	17
		Homefurnishing Retail	17
		Specialty Stores	17
	Textiles Apparel & Luxury Goods	Apparel Accessories & Luxury Goods	6
		Footwear	6
		Textiles	6
Consumer Staples	Beverages	Brewers	10
		Distillers & Vintners	10
		Soft Drinks	14
	Food & Staples Retailing	Drug Retail	13
		Food Distributors	22
		Food Retail	22
		Hypermarkets & Super Centers	22
	Food Products	Agricultural Products	23
		Packaged Foods & Meats	14
	Household Products	Household Products	7
	Personal Products	Personal Products	7
	Tobacco	Tobacco	5
Energy	Energy Equipment & Services	Oil & Gas Drilling	24
		Oil & Gas Equipment & Services	12
	Oil Gas & Consumable Fuels	Coal & Consumable Fuels	15
		Integrated Oil & Gas	15
		Oil & Gas Exploration & Production	24
		Oil & Gas Refining & Marketing	15
		Oil & Gas Storage & Transportation	11
Financials	Banks	Diversified Banks	5
		Regional Banks	5
	Capital Markets	Asset Management & Custody Banks	10

		Financial Exchanges & Data	3
		Investment Banking & Brokerage	10
	Consumer Finance	Consumer Finance	5
	Diversified Financial Services	Multi-Sector Holdings	10
		Other Diversified Financial Services	10
		Specialized Finance	10
	Insurance	Insurance Brokers	3
		Life & Health Insurance	3
		Multi-line Insurance	3
		Property & Casualty Insurance	3
		Reinsurance	3
	Mortgage Real Estate Investment Trusts (REITs)	Mortgage REITs	6
	Thrifts & Mortgage Finance	Thrifts & Mortgage Finance	4
Health Care	Biotechnology	Biotechnology	21
	Health Care Equipment & Supplies	Health Care Equipment	15
		Health Care Supplies	15
	Health Care Providers & Services	Health Care Distributors	7
		Health Care Facilities	1
		Health Care Services	10
		Managed Health Care	1
	Health Care Technology	Health Care Technology	15
	Life Sciences Tools & Services	Life Sciences Tools & Services	15
	Pharmaceuticals	Pharmaceuticals	21
Industrials	Aerospace & Defense	Aerospace & Defense	15
	Air Freight & Logistics	Air Freight & Logistics	20
	Airlines	Airlines	8
	Building Products	Building Products	10
	Commercial Services & Supplies	Commercial Printing	7
		Diversified Support Services	7
		Environmental & Facilities Services	7

		Office Services & Supplies	7
		Security & Alarm Services	7
	Construction & Engineering	Construction & Engineering	10
	Electrical Equipment	Electrical Components & Equipment	10
		Heavy Electrical Equipment	10
	Industrial Conglomerates	Industrial Conglomerates	10
	Machinery	Agricultural & Farm Machinery	10
		Construction Machinery & Heavy Trucks	10
		Industrial Machinery	10
	Marine	Marine	21
	Professional Services	Human Resource & Employment Services	7
		Research & Consulting Services	7
	Road & Rail	Railroads	15
		Trucking	16
	Trading Companies & Distributors	Trading Companies & Distributors	10
	Transportation Infrastructure	Airport Services	20
Information Technology	Communications Equipment	Communications Equipment	9
	Electronic Equipment Instruments & Components	Electronic Components	9
		Electronic Equipment & Instruments	9
		Electronic Manufacturing Services	9
		Technology Distributors	9
	IT Services	Data Processing & Outsourced Services	10
		IT Consulting & Other Services	10
	Internet Software & Services	Internet Software & Services	10
	Semiconductors & Semiconductor Equipment	Semiconductor Equipment	16
		Semiconductors	16
	Software	Application Software	10
		Home Entertainment Software	10
		Systems Software	10
	Technology Hardware Storage & Peripherals	Technology Hardware Storage & Peripherals	11

Materials	Chemicals	Commodity Chemicals	19
		Diversified Chemicals	19
		Fertilizers & Agricultural Chemicals	19
		Industrial Gases	19
		Specialty Chemicals	19
	Construction Materials	Construction Materials	21
	Containers & Packaging	Metal & Glass Containers	21
		Paper Packaging	21
	Metals & Mining	Aluminum	25
		Copper	25
		Diversified Metals & Mining	25
		Gold	25
		Precious Metals & Minerals	25
		Silver	25
		Steel	25
	Paper & Forest Products	Forest Products	5
		Paper Products	18
Real Estate	Equity Real Estate Investment Trusts (REITs)	Diversified REITs	6
		Health Care REITs	6
		Hotel & Resort REITs	6
		Industrial REITs	6
		Office REITs	6
		Residential REITs	6
		Retail REITs	6
		Specialized REITs	6
	Real Estate Management & Development	Diversified Real Estate Activities	3
		Real Estate Development	6
		Real Estate Operating Companies	6
		Real Estate Services	3
Telecommunication Services	Diversified Telecommunication Services	Alternative Carriers	6

		Integrated Telecommunication Services	6
	Wireless Telecommunication Services	Wireless Telecommunication Services	6
Utilities	Electric Utilities	Electric Utilities	18
	Gas Utilities	Gas Utilities	2
	Independent Power and Renewable Electricity Producers	Independent Power Producers & Energy Traders	10
		Renewable Electricity	12
	Multi-Utilities	Multi-Utilities	18
	Water Utilities	Water Utilities	6

Minimum	1
Maximum	25
Average	11.38

Source: Bloomberg data, SASB materiality map,