ESG Investing: From Sin Stocks to Smart Beta*

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Abstract

Research on socially responsible investment in equity markets initially focused on sin stocks. Since then, the availability of data has been extended substantially and now covers environmental, social, and governance (ESG) criteria. Using ESG scores of firms belonging to the MSCI World universe, we measure the impact of score-based exclusion on both passive investment and smart beta strategies. We find that exclusion leads to improved scores of otherwise standard portfolios without deterioration of their risk-adjusted performance. Smart beta strategies exhibit a similar pattern, often in a more pronounced way. Moreover, our results demonstrate that exclusion also implies regional and sectoral tilts as well as (possibly undesirable) risk exposures of the portfolios.

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1 Introduction

Socially responsible investing (SRI), which is commonly defined as an investment approach that incorporates environmental, social, and governance (ESG) factors, is becoming increasingly important in the asset management industry. Several not-for-profit organizations that monitor the evolution of this segment of the industry report impressive inflows.[1] There is also increasing pressure from regulators. In France, for instance, the decree on implementation of Article 173 of TEE (Energy and Environmental Transition Law) now requires all institutional investors to report publicly how they address SRI issues. Similar initiatives are currently being discussed at the European level as well. This trend is taking place at a time of major structural changes in investment styles with the rise of passive investment on one hand and smart beta approaches on the other. The move toward passive investment can be clearly observed by the massive increase in assets invested in exchange-traded funds. Smart beta approaches, while still smaller than passive investments, are gaining traction as investors can expose their portfolios to different investment styles and avoid excessive exposure to capitalization weighted indexes.[2] An important question that arises is how ESG integration affects the nature of the passive and smart beta portfolios. A fundamental concern is that improving the score of the portfolio may result in the deterioration of its performance. For passive investors, integrating weights departing from market capitalization may increase the level of tracking errors with respect to the benchmark. For smart beta, the integration of ESG may reduce the efficiency of the factor that is targeted by the strategy[3].

[1] The Global Sustainable Investment Alliance (2016) reports that worldwide the total assets under management based on some form of sustainable investment strategy amounted to USD 22.9 trillion in 2016, a 25% increase over the two previous years. The proportion of SRI relative to total assets under management is substantial in Europe (52.6%), moderate in the U.S. (21.6%), and low in Japan (3.4%), for a global share equal to 26.3%. The Principles for Responsible Investment, a private initiative supported by the United Nations, have been signed by an increasing number of asset owners, investment managers, and service providers, from 63 in 2006 to 2,898 in 2018 (Principles for Responsible Investment, 2018).

[2] Boston Consulting Group (2018) estimates the total assets under management of the asset management industry at USD 79.2 trillion in 2017. Of those, USD 16 trillion, i.e., approximately 20%, is passively managed. In contrast, smart beta is estimated at USD 430 billion but has been growing by 30% per year since 2012.

[3] A recent survey by FT Russell (2018) highlights the convergence between the ESG and smart beta trends. In their sample of 185 respondents worldwide, the adoption rate of smart beta amounts to 48% in 2018, up from 26% in 2015. Among the asset owners currently implementing smart beta strategies or planning to do so in the near future, 38% of them anticipate applying ESG considerations to their smart beta allocation.

In this paper, we analyze how the properties of an otherwise standard portfolio are affected by the use of an ESG filter. We implement a simple procedure that restricts the investment universe by excluding the companies with the worst ESG scores. Our analysis reveals that the ESG profile of passive portfolios can be improved without deteriorating their overall performance. Similarly, adding an ESG filter in a smart beta strategy does not eliminate the exposure to the desired risk factor, while improving the ESG profile of the portfolio. However, ESG screening also implies regional and sectoral tilts as well as some (possibly undesirable) risk exposure. For instance, almost all the passive portfolios that we consider are negatively exposed to the small-minus-big factor because large firms usually have higher scores than small firms. These results are robust to several dimensions of the investment strategy, such as the regional coverage, the focus on specific ESG criteria, the definition of the exclusion filter, and the choice of the smart beta strategy.

A fundamental question for institutional investors is how to integrate an ESG screening into their investment strategy. Exclusion is a relatively common way to implement ESG strategies. The easiest and still most favored approach is through the exclusion of "sin" industries, such as alcohol, tobacco, or gaming (Fabozzi et al., 2008; Hong and Kacperczyk, 2009). However, the impact may be small because the number and the relative size of the firms excluded remain limited with respect to the overall market. Another approach applies a negative screening directly on firms according to their ESG score or rating (De and Clayman, 2015; Bender et al., 2018). A drawback is that some firms that are engaged in sustainable activities but belong to an industry with low scores on average are often excluded from the ESG portfolio. One way to cope with this issue consists in rescaling the score of a firm according to the score of its peers within the same industry. This approach fosters a positive screening and is called the best-in-class approach (Kempf and Osthoff, 2007; Statman and Glushkov, 2009).[4]

Our analysis is based on a complete dataset collected, constructed, and distributed by MSCI. These data cover the 2007–2017 period and include companies that are covered and rated by MSCI analysts around the world. The sample starts with more than 1,700 companies

[4]Some investors choose to voice their concern through active engagement. Even if this approach clearly has some merits (Dimson et al., 2015a; Gollier and Pouget, 2014), it might prove costly to implement within a global portfolio.

at the beginning of the period and covers approximately 6,500 stocks at the end of the period. Every stock in the sample receives scores on the environmental (E), social (S), and governance (G) issues, which are each composed of specific subcategories. Scores are available on a monthly basis, which is particularly relevant from the perspective of building dynamic portfolios.

We first analyze the impact of ESG screening on the risk and return characteristics of passive portfolios across two main dimensions: (1) Robustness across regions: Most of the research has focused on the U.S. market, and little evidence has been given on whether geography matters. We analyze the consistency of the properties of the portfolios based on ESG screening both worldwide and across large regions (the U.S., Europe, Pacific, and emerging countries). (2) Robustness across ESG criteria: We consider two types of screening mentioned above: the negative exclusion of firms based on their environmental, social, and governance scores and the positive (or best-in-class) screening based on the industry-adjusted average score. The objective is to determine whether these approaches have a different impact on the characteristics of the portfolios after the ESG screening.

The reminder of this paper is organized as follows. In Section 2, we provide a description of the data used. In Section 3, we investigate how the characteristics of passive portfolios based on ESG screening are altered compared to those of the benchmark portfolio. In particular, we evaluate regional and sectoral biases and changes in the exposure to risk factors. In Section 4, we analyze the impact of ESG screening on smart beta strategies. Section 5 concludes the paper.

Relevant literature. At this stage, the literature on SRI is still inconclusive on the relationship between SRI and the risk/return profile of a portfolio. Even if, in practice, SRI are implemented in several alternative ways, the academic literature has mainly investigated two forms. On the one hand, investors invest according to some ethical criterion using a negative screening ("exit"). On the other hand, investors directly intervene in the policy of a firm through active engagement ("voice").

At first glance, ethical screening should result in lower performance. From a theoretical perspective, this practice reduces the universe to a subset of stocks by excluding some bad

companies. For instance, Heinkel et al. (2001) write an equilibrium model with polluting firms. The authors show that the practice of negative screening reduces the pool of available investors, which limits risk sharing and leads to a higher cost of capital. Adler and Kritzman (2008) show in a simulation exercise that excluding some firms necessarily imposes some costs and that investors should expect lower performance. Empirically, firms that are generally screened out tend to perform better over time. Fabozzi et al. (2008), Hong and Kacperczyk (2009), Dimson et al. (2015b), and Luo and Balvers (2017) provide empirical evidence that so-called "sin stocks" (typically, alcohol, tobacco, and gambling) enjoy historically superior performance. Furthermore, El Ghoul et al. (2011) find that firms with high level of corporate social responsibility enjoy lower cost of equity and that companies in sin sectors are subject to higher cost of capital. Chava (2014) also reports that investors demand significantly higher returns for stocks screened out on an environmental basis.

Going beyond screening out companies, several papers have investigated the effect of building a portfolio based on socially responsible criteria. Most of these studies report mixed results and find no evidence of either overperformance or underperformance. Humphrey and Tan (2014) and Statman and Glushkov (2009) report that there is a negative effect from excluding some stocks, which, however, is compensated by a positive effect from overweighting good companies. Mixing negative and positive screenings therefore results in no significant improvement in performance due to SRI. Fernando et al. (2010) provide mixed evidence on the effect of environmental spending by firms, as the stock market does not reward either greenness or toxicity. In contrast, Kempf and Osthoff (2007) present a trading strategy that consists in buying stocks with high ESG rating and selling stocks with low ESG rating, providing substantial abnormal positive returns. Furthermore, Edmans (2011) shows that firms with the best employee satisfaction levels deliver superior returns, and therefore, a positive screen based on that specific issue might prove beneficial in terms of performance. Finally, there are also some interesting arguments made about potential time-varying effects, which may explain these contrasting results. Nofsinger and Varma (2014) study the performance of socially responsible mutual funds over the business cycle and find that these funds tend to underperform in good time but outperform during market crises.

Activism based on SRI practices is another channel to improve a firm's performance. Gompers et al. (2003) report evidence that an investment strategy that buys firms with the strongest shareholder rights and sells firms with the weakest rights would have generated substantial abnormal returns during the 1990s. Bebchuk et al. (2013) demonstrate that this result does not hold over the more recent period. They argue that the disappearance of the correlation between governance and abnormal returns is mostly driven by the gradual learning by market participants about governance practices. Greenwood and Schor (2009) find that investor activism by hedge funds creates value when they are able to effect a change in control. Also focusing on activism, Dimson et al. (2015a) and Gollier and Pouget (2014) argue that active engagement from institutional investors leads to superior returns, in particular for firms with inferior governance.

2 Data and Preliminary Analysis

We use ESG scores for a large set of firms covered by the MSCI ESG database over the period from January 2007 to December 2017. This database has been previously used by Bender et al. (2018), Dunn et al. (2018), and Pollard et al. (2018), among others. Each firm is evaluated according to its exposures or externalities in three complementary areas: (1) Environmental, which includes climate change, natural resources, pollution and waste, and environmental opportunities; (2) Social, which includes human capital, product liability, stakeholder opposition, and social opportunities; and (3) Governance, which includes corporate governance and corporate behavior. For each area, a score (between 0 and 10, 10 representing the best) summarizes the assessment of several key issues identified by MSCI. These scores may suffer from industry biases. For instance, the energy sector is given a particularly low score on average according to the environmental criterion. To mitigate these biases, another score, called the industry-adjusted average ESG score, combines the three E, S, and G scores but accounts for the position of the firm relative to its peers within the industry.

The database covers a large cross section of companies around the world. The number of firms has increased from 1,700 in January 2007 to more than 7,000 in December 2017. To

compare the performance of the strategies to a global benchmark portfolio, we reduce the pool of firms to the firms belonging to the MSCI All Countries World Index (ACWI), which covers large- and mid-cap stocks across 23 developed and 24 emerging markets. In addition to the world market, we consider four large zones, namely, the United States, Europe, Pacific, and emerging countries, and use the corresponding MSCI index as a regional benchmark portfolio. As Figure 1 (Panel A) demonstrates, the coverage of firms belonging to the MSCI index with an ESG score is similar for the U.S. and Europe (from 80% of all firms in the regional index in 2007 to 99% in 2017). Until 2012, the coverage was low for Pacific (below 80%) and emerging countries (below 30%). At the end of the sample, the coverage is at least 90% for all regions. The overall number of firms with an ESG score represents 60% of the number of firms in the MSCI ACWI index at the beginning of the sample and 95% or above since 2013.

Panel B also reveals that the firms with an ESG score represent more than 95% of the market capitalization of the corresponding MSCI index for the U.S. and Europe. The coverage of emerging countries ranges between 40% and 60% until 2012 and is above 90% afterward.

[Insert Figure 1 here]

In Figure 2, we display the temporal evolution of the score of a given criterion averaged over the firms selected in a given region. Panel A indicates that worldwide, the industry-adjusted average ESG score has been relatively stable over the last 10 years, with an average value equal to 5.6. However, there are large discrepancies between regions: Europe is the region with the highest average grade (6.8 on average) and the Pacific is close to the world average (5.8), whereas the U.S. and emerging countries are below the average (5 and 4.2, respectively). Therefore, everything else equal, investors willing to increase the score of their portfolio will tend to overweight firms in Europe and the Pacific. One explanation of why European firms have higher grades than U.S. firms arises from the more stringent regulation in Europe. In particular, the European Union requires firms with more than 500 employees to publish a nonfinancial statement, while the U.S. does not.

The scores of the three criteria exhibit different trends. The trend of the environmental score is positive, with an increase from 5.5 to 6 for the world index (Panel B). All regions benefit from this trend. The average score of emerging countries increases substantially from 4 to 5.5, although it remains below that of the other regions. In contrast, the social score decreases over the sample, from 5.6 to 4.5 for the world index (Panel C). European firms are the most affected, with a decrease from 6.6 to 5, such that the average scores of firms in Europe and the Pacific are close to each other. We also note that, over the recent period, the score of firms in emerging countries is close to the score of U.S. firms, slightly below 4.5. Last, the methodology of the governance score changed in January 2015 so that the comparison of the scores before and after this date is not reliable (Panel D). In the recent period, the average scores of firms in the U.S., Pacific, and emerging countries are in the same ballpark, close to 4.5, while European firms have a score close to 6.

Figure 3 displays the evolution of the industry-adjusted average ESG score for a given industry worldwide. As this score is partly adjusted for differences between industries, we do not observe any significant trend in its temporal evolution, although there is a trough in 2013 in several sectors. Despite the industry adjustment, some industries, such as information technology and telecommunications, have above-average scores (above 6), whereas other industries, such as energy and financials, have below-average scores (below 5.2).[5]

This preliminary analysis indicates that regions and industries exhibit substantial differences in terms of ESG scores. This finding suggests that there is room for constructing portfolios that improve the ESG score relative to the MSCI standard benchmark. At the same time, the finding also highlights that a screening of firms based on their ESG score may result in substantial regional and sectoral biases.

[Insert Figures 2 and 3 here]

[5] As expected, for E, S, and G criteria, which are not adjusted for industries, we find even more substantial biases. For instance, the average environmental score is 4.7 for energy and 7.4 for telecommunications.

3 Empirical Results

Recently, several approaches have been proposed to take ESG criteria into account. Early research has focused on excluding some categories of stocks. For instance, Fabozzi et al. (2008) and Hong and Kacperczyk (2009) study the impact on portfolio performance of excluding "sin" industries. In both papers, the authors report that sin stocks generate excess performance relative to the market on a risk-adjusted basis. To avoid systematically filtering out all firms in a given "sin" industry, negative screening considers the ESG scores at the individual level. MSCI ESG Universal Indexes follow a similar logic by excluding companies found to be in violation of international norms and involved in controversial weapons. The weight of the remaining firms is tilted away from the capitalization weight based upon ESG metrics. To reduce the impact on portfolio performance of the exclusion of firms in "sin" industries, another approach consists in controlling for the industry effect by adjusting scores within each industry. In this "best-in-class" approach, investors select the best firms within each industry. Kempf and Osthoff (2007) and Statman and Glushkov (2009) find that portfolios built on the best-in-class approach generate higher risk-adjusted performance than portfolios built on negative screening. MSCI ESG Leaders Indexes are based on a similar principle. They target companies that have the highest ESG score in each sector of the parent benchmark standard index. These indexes target a 50% sector representation.

We consider both negative screening and best-in-class approaches. We construct portfolios based on the E, S, and G criteria (exclusion approach) and on the industry-adjusted average ESG score (best-in-class approach). We precisely evaluate the impact of exclusion by building a sequence of portfolios that exclude firms with the 1% lowest scores, with the 2% lowest scores, etc., up to firms with the 50% lowest scores. The portfolios are based on the relative capitalization of the remaining firms.

Our first objective is to assess the consistency of the performances of the passive portfolios built on ESG criteria along several dimensions: regions, industries, ESG criteria, and risk factor exposures. For comparability purpose, we consider all our portfolio analyses in U.S. dollars over the 2007–2017 period.

3.1 Robustness across Regions

An important question about applying ESG screening is whether its impact on the resulting portfolio is consistent and uniform across markets. As most of the studies mentioned above focus on the U.S. market, little evidence is known about whether geography matters. In particular, there may be substantial differences between developed and emerging markets. We address this question using a filter based on the industry-adjusted average ESG score and will discuss the effect of using a filter based on E, S, and G scores in Section 3.3.

In Table 1 (Panel A), we report performance statistics on several portfolios of interest for the world, the U.S., Europe, Pacific, and emerging countries. The portfolios are the MSCI standard index for the given zone, the value-weighted portfolio with all firms of the index that have a score at a given point in time (0% excluded), and finally the value-weighted portfolios that exclude the firms with the 10%, 25%, and 50% lowest industry-adjusted average ESG score. As expected, the average score improves as more firms are filtered out. The interesting feature is the magnitude of the improvement. If we first consider the world index (Panel A), the table reveals that the average score increases from 5.56 for the portfolio with no exclusion to 5.91 for the portfolio with the 10% exclusion, and 7.18 for the portfolio with the 50% exclusion. This increase translates into an almost 30% improvement from 0% exclusion to 50% exclusion. This magnitude of improvement is consistent across regions. For regions that start at lower levels (e.g., emerging countries), the improvement is as high as 40%, while those with initially higher grades (e.g., Europe) have a more modest but still substantial improvement above 20%.

A key contribution of this analysis is to consider in parallel the performance of the portfolio. The ESG score is improved without worsening the risk-adjusted performance. For the world portfolio, the annualized return remains roughly constant at levels slightly below 7%, even when more firms are excluded. However, the standard deviation tends to decrease so that the annualized Sharpe ratio is essentially unaffected at 0.4.

When interpreting these results, the regional distribution matters. Figure 4 displays the temporal evolution of the weights of the four regions in the world portfolios with 0%, 10%, 25%, and 50% exclusion. We observe two contrasting trends: On the one hand, the weight of the U.S. and emerging countries in ESG portfolios increases substantially over time (by

approximately 10% and 6%, respectively). For the U.S., this evolution reflects the higher performance of the stock market, which implies a relatively larger market capitalization for U.S. firms. The increase in the weight of emerging countries in ESG portfolios is mostly due to the improvement of the scores relative to the other regions. On the other hand, when more firms are excluded in the ESG portfolio, the weights of firms in the U.S. and emerging countries decrease, whereas more European firms are included. This evolution reflects the lower scores of firms in the U.S. and emerging countries relative to firms in Europe and the Pacific. As a result, over the period considered, being more aggressive in the ESG screening implies an overweighting of firms in Europe and the Pacific and an underweighting of firms in the U.S. and emerging countries. It is worth noting that although Europe considerably lagged the U.S. in terms of market return over the sample, this trend does not affect the performance of ESG portfolios.

When we turn to specific regions, the broad conclusion that the ESG score of passive portfolios can be improved without deteriorating their risk-adjusted performance should be qualified because results are no longer influenced by geographical considerations. As Table 1 indicates, excluding more low-score firms has a limited impact on the U.S. and Pacific portfolios: returns and standard deviations vary in parallel so that the Sharpe ratio is barely affected. For Europe and emerging countries, the Sharpe ratios clearly increase due to both improving performance and decreasing risk levels. Sharpe ratios increase from 0.22 to 0.28 in Europe and from 0.3 to 0.37 in emerging countries when the firms with the 50% lowest scores are excluded.

The tracking error relative to the benchmark portfolio is also an important dimension of risk, especially for institutional investors. Importantly, the table reveals that the tracking error is low for the U.S., Europe, and the Pacific, but higher for emerging countries. When 25% of firms are excluded, the tracking error levels are equal to 1%, 1.1%, 1.6%, and 3%, respectively. This evidence indicates that excluding more firms in emerging countries may generate higher dispersion of the portfolio performance relative to the benchmark.[6]

[6]The large tracking error for emerging countries is to a large extent due to the relatively low coverage of the ESG database for the period before 2013. When the sample starts in January 2013, the tracking error of the portfolio with 25% of firms excluded is equal to 0.9%, 1.2%, 0.8%, and 1.3% in the U.S., Europe, Pacific, and emerging countries, respectively.

Overall, preliminary evidence indicates that the ESG screening procedure is able to improve the ESG profile substantially without deteriorating the risk-return profile of the portfolios. Moreover, this improvement is obtained without taking excessive relative risk as tracking error levels remain at low level. This result is consistent with the conclusion of Statman and Glushkov (2009) that one can build a socially responsible portfolio "doing good while doing well."

[Insert Table 1 and Figure 4 here]

3.2 Robustness across Industries

Another potential bias implied by the portfolios built using ESG screening is the overweighting or underweighting of some industries. Some industries, such as energy, suffer from below-average scores, in particular for the environmental criterion. Using the industry-adjusted average ESG score partly corrects for such an industry bias. However, the resulting portfolio may be more or less exposed to some industries compared to the benchmark portfolio, and in turn, risk and return characteristics may be affected by those industry bets. To investigate this issue, we proceed as follows. For each month of the sample, we determine the industry exposure of portfolios based on excluding a given proportion of low-score firms. We then compare these exposures to the industry exposures of the corresponding MSCI benchmark portfolio.

Figure 5 (Panel A) displays the weights of some industries of particular interest for three portfolios (with 10%, 25%, and 50% exclusion) relative to the MSCI benchmark, based on the industry-adjusted average ESG scores. These industries correspond to a large over- or underweighting. ESG portfolios have a relatively lower weight in the Financial and energy sectors, in particular when the exclusion is large. The underweighting is close to 3% for financials for most of the sample.[7] Energy is on average slightly overweighted at the beginning of the sample, but after 2011, the weight of this industry is on average 2% below the benchmark portfolio. In contrast, information technology and industrials benefit from large

[7]The average weight of financials (including real estate) is equal to 21.2% for the benchmark and 18.4% for the ESG portfolio with 50% of firms excluded.

overweighting. In particular, the weight of information technology is on average 3% higher than its weight in the benchmark portfolio (15.8% versus 12.8%).

Panel B displays the relative weight of the financials and energy sectors when the portfolio is based on the environmental criterion. The underweighting of the energy sector is even more pronounced with this criterion. However, for financials, the picture is different. This sector suffers from an even lower weight after the 2008–2009 financial crisis but compensates afterward. After 2013, for the portfolio with 50% exclusion, the weight of financials in the portfolio based on the environmental criterion is even higher than the weight in the benchmark portfolio.

To the extent that the period covered is particularly favorable to the technology sector and less favorable to financials and energy stocks, the sector biases, just like the regional biases, certainly play an important role in the risk/return profiles of the ESG-filtered portfolios.

[Insert Figure 5 here]

3.3 Best-in-Class Vs Exclusion Approaches

We now assess the impact of excluding low-score firms for E, S, and G criteria without adjustment for the industry (negative exclusion). Several authors have focused on specific areas of ESG investing, for instance Fernando et al. (2010) or Chava (2014) on environmental issues and Edmans (2011) on social norms. As in Section 3.1, we construct portfolios by excluding firms with the lowest scores, but we do this using the individual E, S, and G scores as a screening basis instead of the industry-adjusted average ESG score. As individual scores are not adjusted for the industry, portfolios are more likely to be biased toward some industries. Results reported in Table 1 (Panels B to D) reveal important differences according to the criterion adopted for the screening. On average, when we exclude the firms with the 10%, 25%, and 50% lowest scores, the score improves by 0.3, 0.7, and 1.35, respectively, independently of the ESG criterion.

The case of the environmental criterion (Table 1, Panel B) strengthens some of the evidence observed for the industry-adjusted average ESG score. For almost all regions, the average return increases and the volatility decreases when we exclude low-score firms.

The Sharpe ratio increases accordingly in all regions. For instance, in the U.S., when we exclude firms with the 50% lowest scores, the annualized return increases from 9% to 9.6%, the standard deviation decreases from 14.7% to 14.4% and the Sharpe ratio increases from 0.57 to 0.62. At the same time, the environmental score increases from 5.7 to 6.9. Similar improvements hold for all regions. The tracking error is relatively low (close to 1% for the 25% filter) so that portfolios do not depart excessively from their benchmark. We note that industry biases are usually more pronounced than those reported for the industry-adjusted average score. For the 50% exclusion portfolio, energy is underweighted by 3% and information technology is overweighted by 3% on average relative to the world benchmark portfolio. For the U.S., energy is underweighted by 4.6% and information technology is overweighted by 4.6% on average.

For the social score (Panel C), results indicate that, overall, excluding more low-score firms also allows investors to improve the score of their portfolios without deteriorating risk-adjusted performance. The Sharpe ratio is slightly reduced in the U.S. but improves in other regions. The gain is substantial for Pacific (from 0.26 to 0.31) and emerging countries (from 0.3 to 0.37) for the 50% exclusion portfolio relative to the no-exclusion portfolio. Regarding industry exposures, for the U.S., we find that information technology is again overweighted (by 7.7%) while energy is also overweighted (by 2%).

The results are less favorable for the governance score (Panel D). Excluding firms with low score reduces the average return and increases the volatility for the world, Pacific, and emerging countries. In these three regions, the Sharpe ratio is lower after the exclusion of low-score firms. The reduction is substantial for emerging countries (from 0.3 to 0.22). The exception to this picture is Europe, which benefits from a higher return and lower volatility. A possible explanation for this result is that in Europe, financials are severely underweighted in the governance portfolio (-5.6%). As the performance of financial firms has been lower than other industries in Europe over the period, the portfolio has benefited from a higher average return.

We note that the E, S, and G criteria sometimes have contradictory prescriptions in terms of industry exposure. Energy is a particularly relevant case. Excluding firms with 50% lowest environmental scores results on average in an underweighting of 4.6% in the

U.S. and 2.2% in Europe; similarly, screening with the governance score results in an underweighting of 3.4% and 3.6%, respectively. However, excluding lowest social scores results in overweighting energy by 2% in the U.S. and 0.6% in Europe. In general, industry biases are more pronounced when E, S, and G criteria are used for screening compared to the industry-adjusted average ESG score. This result is expected because the industry-adjusted score is designed to mitigate differences between industry scores. However, despite the more pronounced industry biases, the levels of tracking error are not meaningfully increased with respect to the case where the industry-adjusted score is considered.

All these results indicate that switching to ESG portfolios has different implications in terms of performance depending on the screening criterion. Excluding firms with low scores improves the portfolio performance in most regions for the environmental criterion, has limited impact for the social criterion, and reduces overall performance for the governance criterion. The reason for this different impact on portfolio performance is likely due to a different exposure to risk factors. We now turn to this point.

3.4 Factor Exposure

An important issue in considering portfolios based on an ESG screening is whether this filter generates (possibly undesirable) exposures to some risk factors. As already illustrated, increasing the ESG score requires investing more in Europe and less in the U.S., and more in information technology firms and less in financials and energy firms. There are several reasons why portfolios based on ESG screening may be correlated with traditional factors. For instance, Hong and Kacperczyk (2009) find that sin stocks suffer from lower valuations with respect to the broad market, leading to a potential value effect on those companies. Edmans (2011) mentions that companies with higher employee satisfaction enjoy higher earnings, which might correlate with profitability or quality factors. A size effect is also expected. Large and well-established companies generally spend considerable resources for reporting on ESG matters. Smaller firms are often more reluctant to spend as much, even if they fully comply with all ESG dimensions. Finally, ESG portfolios may be correlated with the momentum factor. Given the increasing importance of SRI, large financial flows are

likely to have temporary impact on some companies with improving or deteriorating ESG scores, creating some momentum effect.

We now explore the consequences of ESG screening on the exposure to standard risk factors. We consider two sets of factors: the four factor model, i.e., the three Fama-French factors plus momentum (Fama and French, 1993, and Carhart, 1993) and the five Fama-French factors (Fama and French, 2015).[8] Tables 2 to 5 report the risk exposures for the portfolios based on the industry-adjusted average score, the E, S, and G scores, respectively.

We begin with the analysis of the four-factor model for the world portfolio and consider the exposure to the various risk factors (Panel A). Almost all world portfolios have a significantly negative exposure to the SMB factor. Most of this effect can be attributed to the fact that the exclusion portfolios (included the case with no exclusion) are equally weighted. With no exclusion, the SMB factor is significant. The loadings are nevertheless increasing with more exclusion, which can be explained by the fact that large firms usually exhibit higher scores. With no exclusion, we also observe a significant positive exposure to the value factor, which is again likely to result from the equally-weighting scheme. However, contrary to the size factor, the exposure to HML decreases with more stringent levels of exclusion. The exclusion process therefore leads to an increased allocation to more expensive stocks. In contrast to size and value, we do not observe any significant loading on the momentum factor. All these results remain broadly valid when we consider single regions (Panel A of table 2) or individual E, S or G dimensions (Panel A of Tables 3 to 5).

We now consider the five-factor Fama-French model (Panel B of Tables 2 to 5). The observations made about the SMB factor remain largely valid in the five-factor model. In contrast, the loading on the HML factor is now almost never significant. This factor is often replaced by a positive loading on the RMW factor. If we take the case of the U.S. with the industry-adjusted average score, the HML loading is close to zero, while the RMW loading increases from 0.03 with no exclusion to a significant 0.11 with 50% exclusion. Excluding

[8]The three Fama-French factors include the market portfolio, the small-minus-big factor (SMB), and the high-minus-low factor (HML). The five Fama-French factors additionally include the robust-minus-weak factor (RMW) and the conservative-minus-aggressive (CMA) factor. For the analysis based on the four-factor model, we use our database to construct our own factors, which allows us to evaluate the risk exposures of the Pacific and emerging countries portfolios. For the five Fama-French factors, we use factors provided on Kenneth French's website. Due to lack of availability, we do not consider the Pacific and emerging countries. Accordingly, we consider developed countries instead of the world and Japan instead of Pacific.

stocks with low ESG score therefore does result in buying more expensive stocks but also in buying higher quality stocks. This effect also suggests that there may be some overlap between ESG screening and quality factors. In terms of individual E, S, and G criteria, the quality bias is the most pronounced for the governance score, with an increasing exposure in all the regions considered.

A separate discussion is worth having for the level of alpha in all specifications. At first glance, in the four-factor model at the world level, the annualized alpha is positive and statistically significant for the industry-adjusted average, environmental, and social criteria. Alpha estimates are close to or above 1%. This fact might lead to the conclusion that ESG screening is associated with a positive premium beyond the usual factors. However, the level of alpha decreases as soon as we move to other specifications. We observe two different features. First, as soon as we move to single regions, the geographical allocation does not matter anymore, and the alpha decreases substantially. This result confirms that a large fraction of the alpha generated at the world level is due to regional bets. Second, alpha also decreases when we go from the four-factor to the five-factor model. Taking the profitability of the companies into account, mostly through the RMW factor, largely explains the apparent value-added of firms with high ESG score. In general, being more aggressive on the ESG score results in loading more on large, profitable, and conservative companies. Once we account for those factors, the alpha decreases compared to the four-factor model and becomes even negative for developed countries and the U.S., although in general insignificantly. This last result is consistent with the evidence reported by Blitz and Fabozzi (2018), who also obtain a negative alpha when RMW and CMA factors are introduced in the factor regression. That being said, there is no indication neither of significantly negative alpha, which means that the ESG screening does not destroy any value. Finally, there are some interesting differences between the individual ESG criteria. While the alpha remains positive and increases for the environmental criterion, it becomes negative for the governance criterion. These results suggest that the environmental risk is not rewarded with a corresponding positive premium, while the governance risk is indeed rewarded as the exclusion of the worst companies leads to a lower alpha.

In summary, the factor analysis highlights that ESG screening might lead to substantial style biases, notably an increase in the exposures to large and profitable companies. While there is no evidence of a positive premium linked to ESG overall, the screening procedure does not lead to a negative alpha, while still improving considerably the ESG profile of the portfolios.

[Insert Tables 2 to 5 here]

4 Smart Beta Approach

Smart beta investing is based on the following logic: the investor builds a portfolio that passively follows an index whose weights are independent from the market capitalization but reflect the exposure to some systematic factor. A well-known example is fundamental indexing (see Arnott et al., 2005), where weights are derived from some variables that proxy for the fundamental value of a company. A similar argument is followed in a value smart beta strategy, which overweights firms with a low price-to-book ratio and underweights firms with a high price-to-book ratio. Current weighting schemes in smart beta focus on traditional factors that have been well documented, such as size (Banz, 1981), value (Basu, 1983), quality (Novy-Marx, 2013), momentum (Jegadeesh and Titman, 1993) or low risk (Frazzini and Pedersen, 2014). Our previous analysis demonstrates that there are significant relationships between ESG and the traditional factors used in typical smart beta approaches. The most obvious factor is size. To the extent that small companies have lower grades, applying an ESG screening on the size factor should result in lower factor exposure and therefore in a significant effect on the performance of a smart beta approach based on the size factor. In contrast, as companies with low ESG scores are also less profitable and more volatile, smart beta portfolios based on quality factors and low risk factors should be less affected.

We now investigate whether applying an ESG screening in the construction of smart beta portfolios affects the performance of the strategy. To address this question, we run the same type of analysis as before, i.e., we exclude progressively the firms with the lowest scores, and we measure the impact of this preliminary screening on a given smart beta strategy.

We consider some of the most popular factors in the smart beta world, i.e., portfolios based on size, low beta, high dividend, value, quality, and momentum. As the objective is not to build the best version of the respective smart beta strategy but rather to assess the broad impact of the ESG filter, we consider versions of smart beta portfolios that do not include any refinements. In each case, we apply the ESG screening (based on the industry-adjusted average ESG score) and then build an equally weighted portfolio of the 100 firms that have the best metric.[9]

Results are reported in Table 6. As in the passive case discussed previously, we report the performance of four portfolios for the same regions as before. The first portfolio is an equally weighted smart beta portfolio based on all the firms that have a score but without any exclusion. The next three portfolios are smart beta portfolios based on excluding firms with the 10%, 25% and 50% lowest scores. Tracking errors are computed with respect to the MSCI standard indexes of the respective regions. For two smart beta strategies, size and momentum, we also illustrate in Figures 6 and 7 how the characteristics of these portfolios are affected when increasingly more firms with low ESG score are excluded, for the U.S. and Europe, respectively.

Observations made for the passive strategies generally hold and are sometimes even accentuated for smart beta strategies. Starting again with the scores, there are even larger improvements than in the passive case. The magnitude nevertheless varies according to the type of smart beta strategy. We begin with the size strategy. As smaller firms generally record lower scores, the smart beta strategy with no exclusion has a very low average score, much lower than the corresponding benchmark index. At the world level, the strategy has an average score equal to 3.18 (see Table 6, Panel A, and Figure 6), whereas the benchmark portfolio has a score equal to 5.56 (see Table 1). The exclusion process improves massively the score by more than 2.5 points, reaching a level higher than the index portfolio when 50% of the firms are excluded (6.59). This result holds for all regions.

[9]For the size approach, we take the companies with the lowest market capitalization. For low beta, we take the companies with the lowest beta, the latter being computed on the last 48 months. For the high dividend approach, we take the companies with the highest dividend yield. For value, we select the companies with the lowest price-to-book ratio. For quality, we take the companies with the highest return on equity. For momentum, we take the firms with the highest difference between the past 12-month return and the last month return. Each strategy is rebalanced on a monthly basis with equal weights.

For the other smart beta strategies, the improvement in the score is less spectacular but still very much present. For instance, at world level, the quality smart beta strategy (based on firm's return on equity) has a relatively high score (5.03) with no exclusion, but it still increases up to 7.10 when 50% of firms are excluded (Panel E). The higher initial level is not really surprising as higher quality companies have higher ESG grades on average. The low beta and high dividend strategies are in the same category as the quality strategy with a substantial score improvement. The momentum strategy also records a score improvement by more than 50% on average.

[Insert Table 6 and Figures 6 and 7 here]

The most interesting feature of implementing smart beta strategies with an ESG screening is again that the large increase in the average score does not deteriorate risk-adjusted performances. In contrast, the ESG screening results in an increase in the Sharpe ratio of most of the smart beta strategies in most regions. Those improvements are usually due to a decrease in the volatility of the strategy. In some cases, we also observe an increase in returns. The size strategy in Europe illustrates this result (Table 6, Panel A). The annualized return increases from 3.65% with no exclusion to 6% with 50% exclusion. In parallel, the portfolio volatility decreases from 24.8% to 23.2%, leading to a doubling of the Sharpe ratio from 0.12 to 0.23.

Another less extreme but also interesting case is the momentum strategy (Panel F). Unlike size or quality, the momentum factor has less stable fundamental characteristics both over time and in the cross section. As a result, there are no obvious intuitive reasons for momentum to structurally correlate in one way or another with ESG portfolios. However, in this case again, the Sharpe ratio improves due to both higher returns and lower volatility. Results on momentum are very robust across regions, as the Sharpe ratio improves by 20% to 40% in all areas (see also Figure 7). Such massive improvements are not observed across all the factors, but Sharpe ratios are either unchanged or higher in the vast majority of strategies and regions.

The only region in which the Sharpe ratio does not systematically increase is emerging countries. In this case, only the low beta and the quality strategies benefit from excluding

firms with low scores and exhibit higher Sharpe ratios when more firms with low score are excluded.

To investigate further the properties of smart beta strategies and in particular identify the reasons for the improvement in risk-adjusted returns, we run a factor analysis similar to the one implemented on passive investment. Tables 7 to 12 report the results for the four-factor and five-factor models. For all smart beta portfolios, the first observation is that factor exposures confirm the profile of the strategy by loading on the associated factor. However, the exclusion process leads quite often to a decrease in the loading of the factor associated with a given smart beta strategy. For instance, for the smart beta strategy based on size, in the world portfolio, the loading on the SMB factor decreases from 1.37 (0% exclusion) to 1.14 (50% exclusion) in the four-factor model, although it remains highly significant. Similarly, for the momentum strategy, the momentum factor loading remains positive but decreases from 0.81 to 0.58. It also decreases for the U.S. and European portfolios. For the value strategy, the factor loading on HML in the U.S. decreases from 0.72 to 0.37. Even if they are not universal, these results suggest that the ESG screening sometimes leads to a less intensive use of the targeted factor. Thus, the ESG screening does not reverse the profile of the smart beta strategy but makes it less efficient.

[Insert Tables 7 to 12 here]

5 Conclusion

Using data over the last 11 years, we broaden the analysis of SRI in equities from the initial exclusion of "sin" industries to a more general and systematic ESG screening on both passive investment and active smart beta strategies. Our results demonstrate that the ESG profile of both passive portfolios and smart beta portfolios can be substantially improved without reducing risk-adjusted returns.

Over the period under study, applying an ESG screening to an otherwise passive portfolio improves the portfolio ESG scores and records unchanged or improved Sharpe ratios. However, ESG screening also leads to substantial regional bets in multicountry portfolios,

in favor of Europe and against the U.S. and emerging countries. This approach also implies large sectoral bets in favor of information technology stocks and against financial and energy stocks. Finally, the ESG screening magnifies some risk exposures relative to the MSCI standard benchmark portfolio. In particular, the exposure to the SMB factor is more negative as larger firms usually benefit from higher ESG scores.

Our results also indicate that the popular smart beta approaches would have benefited from an ESG screening over the period. Even with aggressive exclusions, the targeted factors remain in place. We observe some reduction in the exposure to the targeted factor, but it appears to be compensated by an increase in the ESG profile of the portfolio.

Our main result that the ESG profile of passive investment and smart beta strategies can be improved without deteriorating risk-return performances holds for most regions and for most ESG criteria. This outcome may be at least partly driven by the sample used for the analysis. The period corresponds to a massive transfer of funds toward ESG investing, a process that may have increased the value of firms with high ESG scores and therefore improved the performance of portfolios built upon ESG filters. The (possibly undesirable) exposure of ESG portfolios to some regional or sectoral tilts or to some risk factors may be mitigated by building algorithms that optimize the ESG profile while keeping the exposures to various risk factors under control.

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Table 1: Performance of portfolios based on ESG scores

	MSCI benchmark	0% excl.	10% excl.	25% excl.	50% excl.	0% excl.	10% excl.	25% excl.	50% excl.
		Panel A: Industry-adjusted average score				**Panel B: Environmental score**			
World									
Average score	–	5.56	5.91	6.36	7.18	5.81	6.04	6.37	6.96
Ann. return (%)	7.00	6.91	6.79	6.92	6.84	6.91	6.96	7.07	7.40
Ann. std dev. (%)	16.27	15.97	15.92	15.82	15.83	15.97	15.93	15.88	15.65
Sharpe ratio	0.39	0.39	0.39	0.40	0.39	0.39	0.40	0.40	0.43
Tracking error (%)	–	0.69	0.89	1.11	1.52	0.69	0.81	1.05	1.55
The U.S.									
Average score	–	5.04	5.37	5.84	6.60	5.73	5.96	6.30	6.92
Ann. return (%)	9.01	9.03	8.99	8.98	8.91	9.03	9.10	9.37	9.60
Ann. std dev. (%)	14.69	14.67	14.53	14.41	14.26	14.67	14.61	14.57	14.37
Sharpe ratio	0.57	0.57	0.57	0.58	0.58	0.57	0.58	0.60	0.62
Tracking error (%)	–	0.20	0.54	1.01	1.60	0.22	0.47	0.80	1.47
Europe									
Average score	–	6.84	7.12	7.52	8.36	6.39	6.62	6.90	7.52
Ann. return (%)	4.91	4.93	5.14	5.53	5.91	4.93	4.96	5.08	5.47
Ann. std dev. (%)	19.62	19.52	19.44	19.20	18.65	19.53	19.44	19.18	19.04
Sharpe ratio	0.22	0.22	0.23	0.25	0.28	0.22	0.22	0.23	0.25
Tracking error (%)	–	0.27	0.60	1.10	2.39	0.27	0.59	1.09	2.07
Pacific									
Average score	–	5.73	6.07	6.52	7.38	5.75	6.07	6.44	7.11
Ann. return (%)	4.98	4.75	4.58	4.68	4.85	4.75	4.69	4.60	4.90
Ann. std dev. (%)	16.08	15.78	15.64	15.58	15.53	15.78	15.76	15.65	15.52
Sharpe ratio	0.27	0.26	0.25	0.26	0.27	0.26	0.26	0.25	0.27
Tracking error (%)	–	0.81	1.11	1.62	2.37	0.82	1.04	1.64	2.81
Emerging countries									
Average score	–	4.24	4.57	5.07	5.95	4.80	5.08	5.48	6.09
Ann. return (%)	7.66	7.40	7.29	7.67	9.00	7.38	7.24	7.19	8.30
Ann. std dev. (%)	22.85	22.39	22.28	22.52	22.30	22.39	22.66	22.52	22.55
Sharpe ratio	0.31	0.30	0.30	0.31	0.37	0.30	0.29	0.29	0.34
Tracking error (%)	–	2.25	2.62	3.01	4.11	2.27	2.28	2.89	3.66

Table 1 (Continued)

	MSCI benchmark	0% excl.	10% excl.	25% excl.	50% excl.	0% excl.	10% excl.	25% excl.	50% excl.
		Panel C: Social score				**Panel D: Governance score**			
World									
Average score	–	5.11	5.38	5.73	6.32	5.60	5.94	6.29	7.04
Ann. return (%)	7.00	6.91	6.82	6.73	6.91	6.91	6.69	6.53	6.63
Ann. std dev. (%)	16.27	15.97	15.93	15.92	16.07	15.97	15.87	15.82	16.03
Sharpe ratio	0.39	0.39	0.39	0.38	0.39	0.39	0.38	0.37	0.37
Tracking error (%)	–	0.70	0.80	0.99	1.47	0.72	0.99	1.16	1.47
The U.S.									
Average score	–	4.85	5.12	5.46	5.99	5.46	5.83	6.20	6.95
Ann. return (%)	9.01	9.03	9.02	8.79	8.80	9.03	8.53	8.64	8.96
Ann. std dev. (%)	14.69	14.67	14.66	14.49	14.48	14.67	14.59	14.49	14.54
Sharpe ratio	0.57	0.57	0.57	0.56	0.56	0.57	0.54	0.55	0.57
Tracking error (%)	–	0.25	0.52	1.03	1.79	0.26	0.85	1.04	1.89
Europe									
Average score	–	5.62	5.89	6.28	6.89	6.15	6.53	6.90	7.58
Ann. return (%)	4.91	4.93	5.00	5.02	5.52	4.93	5.09	5.43	5.75
Ann. std dev. (%)	19.62	19.52	19.43	19.55	19.25	19.52	19.25	18.80	18.44
Sharpe ratio	0.22	0.22	0.22	0.22	0.25	0.22	0.23	0.25	0.28
Tracking error (%)	–	0.29	0.81	1.40	2.41	0.30	1.06	1.79	2.70
Pacific									
Average score	–	5.22	5.49	5.78	6.31	5.48	5.85	6.17	6.78
Ann. return (%)	4.98	4.75	4.67	4.85	5.61	4.75	4.73	4.46	4.51
Ann. std dev. (%)	16.08	15.78	15.73	15.82	16.26	15.78	15.63	15.63	15.91
Sharpe ratio	0.27	0.26	0.26	0.27	0.31	0.26	0.26	0.24	0.24
Tracking error (%)	–	0.79	1.05	1.37	2.28	0.82	1.38	1.69	2.60
Emerging countries									
Average score	–	4.56	4.84	5.19	5.75	4.71	5.06	5.43	6.15
Ann. return (%)	7.66	7.40	7.62	8.19	8.96	7.39	7.21	7.12	5.69
Ann. std dev. (%)	22.85	22.39	22.45	22.45	22.26	22.39	22.28	22.32	22.75
Sharpe ratio	0.31	0.30	0.31	0.34	0.37	0.30	0.29	0.29	0.22
Tracking error (%)	–	2.24	2.39	2.79	3.82	2.25	2.42	2.92	4.18

Note: The table reports summary statistics on portfolios based on the ESG screening based on the industry-adjusted average ESG score, the environmental score, the social score, and the governance score, in Panels A to D, respectively. Statistics are: the average score, the annualized average return, the annualized standard deviation, the Sharpe ratio, and the annualized tracking error (relative to the MSCI standard benchmark of the respective region). Column 1 corresponds to the MSCI benchmark portfolio for the region considered. For each panel, columns correspond to the portfolio with no exclusion and the portfolios excluding the firms with the 10%, 25%, and 50% lowest scores.

Table 2: Factor exposure of portfolios based on industry-adjusted average ESG score

	0% excl.	10% excl.	25% excl.	50% excl.		0% excl.	10% excl.	25% excl.	50% excl.
	Panel A: 3 FFF + Momentum					**Panel B: 5 FFF**			
World					**Developed countries**				
Ann. α	0.91*	0.86*	1.01*	0.79	Ann. α	−0.07	−0.41	−0.64	−0.93*
Market	0.97*	0.96*	0.96*	0.97*	Market	0.98*	0.99*	0.99*	1.00*
SMB	−0.21*	−0.23*	−0.25*	−0.25*	SMB	−0.17*	−0.18*	−0.19*	−0.21*
HML	0.07*	0.08*	0.07*	0.03	HML	0.02	0.03	0.03	0.00
MOM	−0.01	−0.02	−0.02	−0.03	RMW	0.04	0.08*	0.14*	0.20*
					CMA	0.03	0.05*	0.06*	0.08*
The U.S.					**The U.S.**				
Ann. α	0.06	0.09	0.07	−0.24	Ann. α	−0.30	−0.40	−0.43	−0.67
Market	1.00*	0.99*	0.99*	1.00*	Market	1.00*	1.00*	0.99*	1.00*
SMB	−0.03*	−0.03*	−0.07*	−0.12*	SMB	−0.12*	−0.12*	−0.14*	−0.17*
HML	0.01*	0.01	−0.01	−0.08*	HML	0.01	0.01	0.01	−0.02
MOM	0.00	−0.01	−0.01	−0.05*	RMW	0.03*	0.06*	0.08*	0.11*
					CMA	0.00	0.00	−0.01	−0.06*
Europe					**Europe**				
Ann. α	0.25	0.37	0.71	0.73	Ann. α	0.12	−0.04	0.08	0.23
Market	0.98*	0.99*	0.98*	0.98*	Market	0.98*	0.98*	0.98*	0.97*
SMB	−0.05*	−0.07*	−0.09*	−0.07*	SMB	−0.19*	−0.20*	−0.21*	−0.19*
HML	−0.01	−0.02*	−0.06*	−0.09*	HML	0.02	0.02	0.00	−0.12
MOM	−0.01*	−0.02*	−0.04*	0.00	RMW	0.03	0.08	0.13*	0.11
					CMA	−0.05	−0.02	0.00	0.06
Pacific					**Japan**				
Ann. α	−0.58	−0.71	−0.54	−0.09	Ann. α	0.02	0.02	0.39	1.00
Market	1.00*	0.99*	0.98*	0.98*	Market	1.01*	1.00*	0.99*	0.98*
SMB	0.02	0.02	0.03	−0.05	SMB	−0.20*	−0.22*	−0.22*	−0.24*
HML	0.04	0.04*	0.02	0.01	HML	0.03	0.03	0.04	0.04
MOM	0.00	−0.01	−0.02	0.00	RMW	−0.09*	−0.08*	−0.03	0.05
					CMA	−0.06*	−0.05*	−0.04	0.01
Emerging countries									
Ann. α	0.37	0.34	0.74	2.11					
Market	0.97	0.96	0.97	0.96					
SMB	−0.09*	−0.10*	−0.15*	−0.13*					
HML	0.12*	0.13*	0.12*	0.05					
MOM	0.03*	0.02	−0.01	−0.03					

Note: The table reports summary statistics on portfolios based on the industry-adjusted average ESG score. Statistics are: the annualized alpha (in %) and the sensitivity to risk factors. Columns 1 to 4 correspond to the four-factor model; columns 5 to 9 correspond to the five-factor model. Columns correspond to the the portfolio with no exclusion and the portfolios excluding the firms with the 10%, 25%, and 50% lowest scores. A "*" indicates that the parameter estimate is significant at the 5% level.

Table 3: Factor exposure of portfolios based on environmental score

	0% excl.	10% excl.	25% excl.	50% excl.		0% excl.	10% excl.	25% excl.	50% excl.
	Panel A: 3 FFF + Momentum					**Panel B: 5 FFF**			
World					**Developed countries**				
Ann. α	0.92*	0.95*	1.13*	1.55*	Ann. α	−0.05	0.01	0.10	0.35
Market	0.97*	0.97*	0.97*	0.96*	Market	0.99*	0.99*	0.99*	0.98*
SMB	−0.22*	−0.24*	−0.27*	−0.32*	SMB	−0.17*	−0.19*	−0.22*	−0.22*
HML	0.07*	0.06*	0.07*	0.05*	HML	0.02	0.00	−0.01	−0.01
MOM	−0.01	−0.02	−0.02	−0.02	RMW	0.04	0.04	0.02	0.03
					CMA	0.03	0.03	0.05	0.05
The U.S.					**The U.S.**				
Ann. α	0.06	0.06	0.31	0.72*	Ann. α	−0.30	−0.31	0.05	0.44
Market	1.00*	1.01*	1.01*	1.00*	Market	1.00*	1.00*	1.00*	0.99*
SMB	−0.03*	−0.05*	−0.08*	−0.13*	SMB	−0.12*	−0.12*	−0.14*	−0.15*
HML	0.01*	−0.01	−0.01	0.00	HML	0.01	−0.01	0.00	0.00
MOM	0.00	−0.01	−0.01*	−0.02	RMW	0.03*	0.04*	0.03	0.03
					CMA	0.01	0.00	−0.02	−0.01
Europe					**Europe**				
Ann. α	0.24	0.22	0.33	0.67	Ann. α	0.10	0.03	0.06	0.83
Market	0.98*	0.98*	0.98*	0.97*	Market	0.98*	0.98*	0.97*	0.96*
SMB	−0.05*	−0.06*	−0.08*	−0.11*	SMB	−0.18*	−0.19*	−0.20*	−0.20*
HML	−0.01	−0.01	−0.01	−0.01	HML	0.02	0.01	−0.02	−0.08
MOM	−0.01*	−0.01	0.00	0.02	RMW	0.03	0.03	0.04	−0.03
					CMA	−0.05	−0.03	0.00	−0.01
Pacific					**Japan**				
Ann. α	−0.50	−0.56	−0.59	−0.19	Ann. α	0.32	0.47	0.13	0.67
Market	1.00*	1.00*	0.99*	0.97*	Market	1.01*	1.00*	1.00*	0.99*
SMB	0.01	0.00	−0.01	−0.02	SMB	−0.20*	−0.23*	−0.24*	−0.25*
HML	0.03	0.03*	0.03	0.04	HML	0.03	0.03	0.05	0.09*
MOM	0.00	−0.01	−0.02	−0.01	RMW	−0.07*	−0.06	−0.01	0.09
					CMA	−0.06*	−0.06*	−0.04	−0.03
Emerging countries									
Ann. α	0.37	0.14	0.22	1.37					
Market	0.97*	0.98*	0.98*	0.97*					
SMB	−0.09*	−0.10*	−0.14*	−0.15*					
HML	0.13*	0.11*	0.12*	0.12*					
MOM	0.03*	0.01	0.00	0.00					

Note: The table reports summary statistics on portfolios based on the environmental score. Statistics are: the annualized alpha (in %) and the sensitivity to risk factors. Columns 1 to 4 correspond to the four-factor model; columns 5 to 9 correspond to the five-factor model. Columns correspond to the the portfolio with no exclusion and the portfolios excluding the firms with the 10%, 25%, and 50% lowest scores. A "*" indicates that the parameter estimate is significant at the 5% level.

Table 4: Factor exposure of portfolios based on social score

	0% excl.	10% excl.	25% excl.	50% excl.		0% excl.	10% excl.	25% excl.	50% excl.
	Panel A: 3 FFF + Momentum					**Panel B: 5 FFF**			
World					**Developed countries**				
Ann. α	0.90*	0.87*	0.77*	0.95*	Ann. α	−0.06	−0.19	−0.48	−0.66
Market	0.97*	0.96*	0.96*	0.97*	Market	0.98*	0.98*	0.99*	1.00*
SMB	−0.21*	−0.22*	−0.22*	−0.23*	SMB	−0.17*	−0.17*	−0.17*	−0.15*
HML	0.07*	0.08*	0.08*	0.09*	HML	0.02	0.02	0.01	0.05
MOM	−0.01	−0.01	0.00	0.00	RMW	0.03	0.03	0.04	0.08
					CMA	0.03	0.02	0.03	0.05
The U.S.					**The U.S.**				
Ann. α	0.09	0.01	−0.12	−0.31	Ann. α	−0.29	−0.33	−0.58	−0.85
Market	1.00*	1.00*	0.99*	1.00*	Market	1.00*	1.00*	0.99*	1.00*
SMB	−0.02*	−0.02*	−0.04*	−0.09*	SMB	−0.11*	−0.11*	−0.10*	−0.12*
HML	0.01*	0.00	0.01	−0.05*	HML	0.01	0.01	0.00	0.01
MOM	0.00	−0.01	0.00	−0.03	RMW	0.03*	0.04*	0.06*	0.12*
					CMA	0.00	−0.03	−0.02	−0.07
Europe					**Europe**				
Ann. α	0.19	0.27	0.34	0.82	Ann. α	0.08	0.07	0.04	0.87
Market	0.98*	0.98*	0.98*	0.97*	Market	0.98*	0.98*	0.99*	0.98*
SMB	−0.05*	−0.06*	−0.08*	−0.11*	SMB	−0.18*	−0.19*	−0.18*	−0.20*
HML	0.00	0.00	0.03*	0.05*	HML	0.02	0.00	0.00	−0.08
MOM	−0.01*	0.00	0.02	0.06*	RMW	0.03	0.02	0.01	−0.08
					CMA	−0.05	−0.02	0.03	0.10
Pacific					**Japan**				
Ann. α	−0.57	−0.68	−0.38	0.19	Ann. α	0.21	0.32	0.78	1.57
Market	1.00*	1.00*	1.00*	1.02*	Market	1.01*	1.02*	1.02*	1.05*
SMB	0.02	0.03	−0.02	−0.01	SMB	−0.20*	−0.20*	−0.23*	−0.27*
HML	0.04	0.04*	0.04*	0.07*	HML	0.03*	0.02	0.02	0.08*
MOM	0.00	0.00	0.00	0.02	RMW	−0.09*	−0.10*	−0.07*	−0.05
					CMA	−0.06*	−0.07*	−0.06*	−0.06
Emerging countries									
Ann. α	0.41	0.58	1.18	2.01					
Market	0.97*	0.97*	0.97*	0.97*					
SMB	−0.09*	−0.08*	−0.09*	−0.14*					
HML	0.12*	0.12*	0.13*	0.00					
MOM	0.02*	0.02	0.02	−0.04					

Note: The table reports summary statistics on portfolios based on the social score. Statistics are: the annualized alpha (in %) and the sensitivity to risk factors. Columns 1 to 4 correspond to the four-factor model; columns 5 to 9 correspond to the five-factor model. Columns correspond to the the portfolio with no exclusion and the portfolios excluding the firms with the 10%, 25%, and 50% lowest scores. A "*" indicates that the parameter estimate is significant at the 5% level.

Table 5: Factor exposure of portfolios based on governance score

	0% excl.	10% excl.	25% excl.	50% excl.		0% excl.	10% excl.	25% excl.	50% excl.
	Panel A: 3 FFF + Momentum					**Panel B: 5 FFF**			
World					**Developed countries**				
Ann. α	0.90*	0.65	0.44	0.41	Ann. α	−0.13	−0.84*	−1.03*	−0.87
Market	0.97*	0.96*	0.97*	0.98*	Market	0.99*	0.99*	0.99*	1.01*
SMB	−0.22*	−0.22*	−0.23	−0.22*	SMB	−0.17*	−0.17*	−0.18*	−0.18*
HML	0.07*	0.05*	0.03	0.00	HML	0.02	0.01	−0.01	−0.02
MOM	−0.01	−0.02	−0.02	−0.04*	RMW	0.04	0.14*	0.13*	0.14*
					CMA	0.03	0.07	0.07	0.04
The U.S.					**The U.S.**				
Ann. α	0.09	−0.46	−0.34	−0.22	Ann. α	−0.27	−1.06*	−0.84*	−0.59
Market	1.00*	1.00*	0.99*	1.00*	Market	1.00*	1.01*	1.00*	1.00*
SMB	−0.03*	−0.01	−0.02	−0.01	SMB	−0.12*	−0.12*	−0.12*	−0.10*
HML	0.02*	0.00	−0.01	−0.05	HML	0.01	−0.02	−0.02	−0.03
MOM	0.00	0.00	0.00	−0.01	RMW	0.02	0.07*	0.07*	0.07*
SMB					CMA	0.00	0.03	−0.01	−0.02
Europe					**Europe**				
Ann. α	0.23	0.12	0.28	0.52	Ann. α	0.05	−0.52	−0.75	−0.23
Market	0.98*	0.99*	0.98*	0.97*	Market	0.98*	0.98*	0.98*	0.96*
SMB	−0.05*	−0.04*	−0.03	−0.03	SMB	−0.18*	−0.18*	−0.17*	−0.20*
HML	−0.01	−0.06*	−0.10*	−0.15*	HML	0.02	0.00	−0.05	−0.08
MOM	−0.01*	−0.02*	−0.02	−0.04*	RMW	0.04	0.14*	0.21*	0.22*
					CMA	−0.05	−0.01	0.06	−0.02
Pacific					**Japan**				
Ann. α	−0.67	−0.48	−0.68	−0.76	Ann. α	0.12	0.42	−0.16	−0.58
Market	1.00*	0.99*	0.98*	0.99*	Market	1.01*	1.00*	0.98*	0.98*
SMB	0.02	0.04	0.05	0.06	SMB	−0.20*	−0.20*	−0.21*	−0.20*
HML	0.04	0.00	−0.03	−0.01	HML	0.02	−0.04	−0.03	0.06
MOM	0.00	−0.01	−0.02	−0.02	RMW	−0.08*	−0.04	0.03	0.13
					CMA	−0.04	0.02	0.03	−0.05
Emerging countries									
Ann. α	0.37	0.19	0.15	−1.37					
Market	0.97*	0.97*	0.97*	0.98*					
SMB	−0.09*	−0.07	−0.10*	−0.07					
HML	0.13*	0.11*	0.11*	0.07					
MOM	0.03	0.03	0.01	−0.02					

Note: The table reports summary statistics on portfolios based on the governance score. Statistics are: the annualized alpha (in %) and the sensitivity to risk factors. Columns 1 to 4 correspond to the four-factor model; columns 5 to 9 correspond to the five-factor model. Columns correspond to the portfolio with no exclusion and the portfolios excluding the firms with the 10%, 25%, and 50% lowest scores. A "*" indicates that the parameter estimate is significant at the 5% level.

Table 6: Performance of smart beta portfolios based on industry-adjusted average ESG score

	0% excl.	10% excl.	25% excl.	50% excl.	0% excl.	10% excl.	25% excl.	50% excl.
	Panel A: Size strategy				**Panel B: Low beta strategy**			
World								
Average score	3.91	4.54	5.34	6.59	4.63	5.02	5.60	6.80
Ann. return (%)	7.20	7.47	7.03	8.33	5.27	5.77	6.02	7.73
Ann. std dev. (%)	25.43	25.39	24.27	23.60	11.09	11.11	10.98	10.87
Sharpe ratio	0.26	0.27	0.26	0.33	0.42	0.46	0.49	0.65
Tracking error (%)	11.06	11.20	11.47	12.42	2.69	2.98	3.21	4.31
The U.S.								
Average score	3.71	4.20	4.87	5.94	4.42	4.84	5.40	6.32
Ann. return (%)	11.52	11.12	11.44	11.16	9.22	8.83	9.31	9.70
Ann. std dev. (%)	23.64	22.93	22.05	21.99	12.28	12.23	12.20	12.16
Sharpe ratio	0.46	0.46	0.49	0.48	0.70	0.67	0.71	0.74
Tracking error (%)	2.14	2.57	3.88	5.08	1.12	1.46	2.06	3.28
Europe								
Average score	6.00	6.55	7.14	8.09	6.50	6.96	7.45	8.26
Ann. return (%)	3.65	4.43	5.35	6.00	5.61	5.94	5.44	5.59
Ann. std dev. (%)	24.79	24.60	24.35	23.21	15.43	15.71	16.27	16.20
Sharpe ratio	0.12	0.15	0.19	0.23	0.32	0.34	0.29	0.31
Tracking error (%)	2.14	2.83	3.86	5.11	0.60	1.28	2.11	2.49
Pacific								
Average score	4.78	5.22	5.87	6.81	4.96	5.37	5.93	6.96
Ann. return (%)	10.30	9.91	9.52	10.98	6.59	6.94	7.73	8.02
Ann. std dev. (%)	18.66	18.37	18.11	18.70	12.50	12.61	12.92	12.72
Sharpe ratio	0.52	0.50	0.49	0.55	0.48	0.50	0.55	0.58
Tracking error (%)	2.75	3.04	3.42	4.27	1.33	1.75	3.03	4.59
Emerging countries								
Average score	3.51	3.87	4.54	5.43	3.97	4.26	4.87	5.72
Ann. return (%)	10.29	9.92	9.12	10.06	6.77	6.44	7.83	8.73
Ann. std dev. (%)	25.50	25.42	25.58	25.39	17.35	17.22	17.55	18.03
Sharpe ratio	0.38	0.36	0.33	0.37	0.35	0.34	0.41	0.45
Tracking error (%)	8.58	8.91	9.77	10.88	4.76	4.81	5.14	6.58

Table 6 (Continued)

	0% excl.	10% excl.	25% excl.	50% excl.	0% excl.	10% excl.	25% excl.	50% excl.
	Panel C: High yield strategy				**Panel D: Value strategy**			
World								
Average score	5.03	5.52	6.17	7.06	4.64	5.05	5.64	6.90
Ann. return (%)	4.44	4.54	4.44	5.52	6.38	6.49	7.07	7.63
Ann. std dev. (%)	23.40	23.48	23.10	22.42	30.84	30.00	28.44	26.43
Sharpe ratio	0.16	0.17	0.16	0.22	0.19	0.19	0.23	0.26
Tracking error (%)	4.12	4.62	5.09	5.89	5.16	5.95	6.62	8.62
The U.S.								
Average score	4.51	4.90	5.43	6.29	3.98	4.45	5.10	6.09
Ann. return (%)	8.70	8.57	8.76	9.42	8.22	7.95	8.38	8.61
Ann. std dev. (%)	17.72	17.96	17.22	16.78	24.59	23.96	22.16	21.34
Sharpe ratio	0.45	0.44	0.47	0.52	0.31	0.30	0.35	0.37
Tracking error (%)	0.92	1.42	2.66	3.97	1.40	1.94	4.00	5.55
Europe								
Average score	6.57	6.96	7.40	8.17	6.22	6.72	7.37	8.24
Ann. return (%)	3.53	3.58	4.00	4.08	3.38	3.36	4.00	4.10
Ann. std dev. (%)	23.47	23.51	22.83	22.36	29.65	29.07	27.62	25.78
Sharpe ratio	0.12	0.12	0.15	0.15	0.09	0.09	0.12	0.13
Tracking error (%)	1.11	1.25	2.24	3.12	1.40	2.77	4.93	6.73
Pacific								
Average score	5.41	5.81	6.36	7.18	5.02	5.45	6.11	7.15
Ann. return (%)	8.90	8.98	8.64	8.86	10.39	10.19	9.64	10.20
Ann. std dev. (%)	19.76	19.03	18.57	18.89	19.19	18.55	18.23	18.02
Sharpe ratio	0.42	0.44	0.43	0.43	0.51	0.51	0.49	0.53
Tracking error (%)	1.15	2.00	2.94	3.49	2.09	2.54	3.17	4.40
Emerging countries								
Average score	4.06	4.39	5.00	5.92	3.89	4.13	4.67	5.49
Ann. return (%)	10.06	9.11	9.23	9.40	8.46	7.27	7.19	7.72
Ann. std dev. (%)	22.19	22.02	21.86	21.80	27.30	27.55	27.94	26.72
Sharpe ratio	0.42	0.38	0.39	0.40	0.29	0.24	0.23	0.26
Tracking error (%)	5.27	5.46	5.88	7.25	6.84	7.18	7.74	9.32

Table 6 (Continued)

	0% excl.	10% excl.	25% excl.	50% excl.	0% excl.	10% excl.	25% excl.	50% excl.
	Panel E: Quality strategy				**Panel F: Momentum strategy**			
World								
Average score	5.08	5.55	6.16	7.10	4.34	4.97	5.70	6.84
Ann. return (%)	9.27	8.71	8.80	9.04	7.11	7.19	7.37	7.73
Ann. std dev. (%)	16.97	17.05	17.20	16.37	19.61	19.32	18.72	17.03
Sharpe ratio	0.51	0.47	0.47	0.51	0.33	0.34	0.36	0.42
Tracking error (%)	2.76	2.79	3.16	3.74	6.76	7.44	8.04	9.72
The U.S.								
Average score	4.65	5.07	5.54	6.42	4.20	4.66	5.24	6.23
Ann. return (%)	11.77	11.19	11.05	11.65	9.62	9.55	10.12	10.30
Ann. std dev. (%)	16.09	15.97	15.73	15.66	16.78	16.48	16.02	15.55
Sharpe ratio	0.69	0.66	0.66	0.70	0.53	0.54	0.59	0.62
Tracking error (%)	1.16	1.64	2.01	2.53	2.03	2.73	3.87	4.66
Europe								
Average score	6.48	6.94	7.44	8.28	6.45	6.89	7.46	8.30
Ann. return (%)	8.13	8.24	7.99	8.32	7.30	6.97	7.56	8.51
Ann. std dev. (%)	18.72	18.76	18.98	18.74	19.32	19.35	19.12	19.02
Sharpe ratio	0.40	0.40	0.39	0.41	0.34	0.33	0.36	0.41
Tracking error (%)	1.06	1.50	1.93	2.39	1.31	1.63	2.51	3.34
Pacific								
Average score	4.95	5.50	6.15	7.09	5.12	5.62	6.20	7.13
Ann. return (%)	8.16	7.73	7.23	6.47	6.18	5.87	6.66	6.86
Ann. std dev. (%)	18.70	18.25	17.85	17.94	16.48	16.31	15.92	15.84
Sharpe ratio	0.40	0.39	0.37	0.32	0.34	0.32	0.38	0.39
Tracking error (%)	2.23	2.96	3.90	4.21	1.63	2.12	2.85	3.23
Emerging countries								
Average score	4.02	4.31	4.97	5.93	3.74	4.13	4.75	5.74
Ann. return (%)	9.44	9.77	11.21	13.36	10.92	10.35	10.32	11.07
Ann. std dev. (%)	22.61	22.43	22.68	22.60	21.96	21.56	21.41	21.43
Sharpe ratio	0.39	0.41	0.47	0.56	0.47	0.45	0.45	0.49
Tracking error (%)	4.72	4.91	4.85	6.27	6.35	6.98	7.44	8.49

Note: The table reports summary statistics on smart beta portfolios based on the industry-adjusted average ESG score. Smart beta strategies are: size, low beta, high yield, value, quality, and momentum, as reported in Panels A to F, respectively. Statistics are: the average score, the annualized average return, the annualized standard deviation, the Sharpe ratio, and the annualized tracking error (relative to the MSCI standard benchmark of the respective region). For each panel, columns correspond to the portfolio with no exclusion and the portfolios excluding the firms with the 10%, 25%, and 50% lowest scores.

Table 7: Factor exposure of size portfolios based on industry-adjusted average ESG score

	0% excl.	10% excl.	25% excl.	50% excl.		0% excl.	10% excl.	25% excl.	50% excl.
	Panel A: 3 FFF + Momentum					**Panel B: 5 FFF**			
World					**Developed countries**				
Ann. α	0.00	0.38	−0.16	0.80	Ann. α	1.75	2.10	1.20	1.46
Market	0.99*	1.00*	0.99*	1.02*	Market	1.14*	1.13*	1.12*	1.14*
SMB	1.37*	1.31*	1.27*	1.14*	SMB	0.70*	0.70*	0.69*	0.66*
HML	0.46*	0.49*	0.46*	0.35*	HML	0.96*	0.94*	0.93*	0.77*
MOM	−0.12	−0.11	−0.05	−0.03	RMW	0.17	0.17	0.21	0.24
					CMA	−1.04*	−0.81*	−0.87*	−0.69*
The U.S.					**The U.S.**				
Ann. α	2.16	1.88	2.23	1.23	Ann. α	−0.15	−0.31	0.42	0.14
Market	0.99*	0.98*	0.99*	1.03*	Market	1.22*	1.19*	1.18*	1.20*
SMB	1.22*	1.21*	1.11*	1.07*	SMB	0.55*	0.55*	0.45*	0.39*
HML	0.20*	0.20*	0.22*	0.11	HML	0.45*	0.40*	0.39*	0.37*
MOM	−0.23*	−0.19*	−0.12*	−0.15*	RMW	0.18	0.16	0.11	0.07
					CMA	−0.33	−0.30	−0.30	−0.39*
Europe					**Europe**				
Ann. α	−1.33	−0.66	0.02	0.99	Ann. α	−2.87	−2.13	−1.80	−1.37
Market	1.02*	1.02*	1.03*	0.97*	Market	1.09*	1.10*	1.11*	1.06*
SMB	1.05*	1.05*	1.03*	0.98*	SMB	0.41*	0.40*	0.43*	0.43*
HML	0.08	0.05	0.04	0.05	HML	0.58*	0.51*	0.45*	0.44*
MOM	−0.08*	−0.09*	−0.05	−0.04	RMW	0.33	0.28	0.32*	0.37*
					CMA	−0.42*	−0.35*	−0.26	−0.17
Pacific					**Japan**				
Ann. α	1.81	1.53	1.61	3.16*	Ann. α	4.31*	4.71*	4.59*	6.18*
Market	1.06*	1.04*	1.03*	1.06*	Market	1.06*	1.0*	1.04*	1.03*
SMB	0.94*	0.97*	0.92*	0.90*	SMB	0.05	0.05	0.06	0.03
HML	0.12*	0.09*	−0.01	−0.06	HML	0.27*	0.27*	0.28*	0.30*
MOM	−0.08*	−0.07*	−0.11*	−0.14*	RMW	−0.14	−0.09	−0.08	−0.01
					CMA	−0.33*	−0.34*	−0.34*	−0.36*
Emerging countries									
Ann. α	2.74	2.39	1.62	2.57					
Market	0.98*	0.97*	0.99*	1.00*					
SMB	0.42*	0.41*	0.34*	0.29*					
HML	0.20*	0.19*	0.13	−0.01					
MOM	−0.14	−0.15*	−0.19*	−0.24*					

Note: The table reports summary statistics on size portfolios based on the industry-adjusted average ESG score. Statistics are: the annualized alpha (in %) and the sensitivity to risk factors. Columns 1 to 4 correspond to the four-factor model; columns 5 to 8 correspond to the five-factor model. Columns correspond to the portfolio with no exclusion and the portfolios excluding the firms with the 10%, 25%, and 50% lowest scores. A "*" indicates that the parameter estimate is significant at the 5% level.

Table 8: Factor exposure of low beta portfolios based on industry-adjusted average ESG score

	0% excl.	10% excl.	25% excl.	50% excl.		0% excl.	10% excl.	25% excl.	50% excl.
	Panel A: 3 FFF + Momentum					**Panel B: 5 FFF**			
World					**Developed countries**				
Ann. α	2.20	2.73	2.72	3.58	Ann. α	−0.87	−0.79	−0.60	1.21
Market	0.40*	0.40*	0.43*	0.50*	Market	0.56*	0.55*	0.57*	0.65*
SMB	0.09	0.09	0.06	0.12	SMB	0.13	0.12	0.12	0.19
HML	0.09	0.09	0.04	−0.07	HML	−0.22	−0.23	−0.22	−0.32
MOM	0.06	0.06	0.04	0.03	RMW	0.45	0.42	0.43	0.44*
					CMA	0.66*	0.65*	0.59*	0.66*
The U.S.					**The U.S.**				
Ann. α	2.85	2.47	2.97	2.84	Ann. α	1.75	1.46	2.01	2.24
Market	0.72*	0.73*	0.73*	0.77*	Market	0.85*	0.75*	0.76*	0.79*
SMB	−0.09	−0.08	−0.08	−0.07	SMB	−0.17*	−0.16*	−0.17*	−0.16*
HML	0.09	0.10	0.12	0.05	HML	0.00	0.01	0.01	0.02
MOM	0.05	0.06	0.05	0.01	RMW	0.12	0.10	0.07	0.05
					CMA	0.28	0.18	0.20	0.12
Europe					**Europe**				
Ann. α	0.38	0.75	0.37	0.46	Ann. α	−1.08	−0.77	−0.73	−0.69
Market	0.81*	0.81*	0.83*	0.83*	Market	0.85*	0.86*	0.88*	0.87*
SMB	0.29*	0.30*	0.27*	0.27*	SMB	0.06	0.05	−0.01	0.01
HML	−0.24*	−0.24*	−0.18*	−0.17*	HML	−0.30*	−0.26*	−0.24*	−0.26*
MOM	−0.04	−0.06	−0.03	0.00	RMW	0.19	0.21	0.13	0.14
					CMA	0.28*	0.26*	0.21*	0.23*
Pacific					**Japan**				
Ann. α	1.14	1.50	2.10	2.56	Ann. α	1.29	1.52	1.87	3.29
Market	0.55*	0.5*	0.63*	0.67*	Market	0.75*	0.74*	0.74*	0.75*
SMB	0.77*	0.75*	0.70*	0.56*	SMB	0.22*	0.23*	0.27*	0.19*
HML	0.11	0.11	0.11	0.12	HML	−0.29*	−0.30*	−0.29*	−0.29*
MOM	0.25*	0.24*	0.24*	0.23*	RMW	−0.11	−0.09	−0.08	−0.01
					CMA	0.34*	0.33*	0.32*	0.32*
Emerging countries									
Ann. α	0.99	0.74	1.95	2.81					
Market	0.72*	0.71*	0.74*	0.78*					
SMB	0.20*	0.22*	0.21*	0.09					
HML	−0.02	−0.01	−0.13*	−0.16*					
MOM	0.01	0.01	−0.03	−0.05					

Note: The table reports summary statistics on low beta portfolios based on the industry-adjusted average ESG score. Statistics are: the annualized alpha (in %) and the sensitivity to risk factors. Columns 1 to 4 correspond to the four-factor model; columns 5 to 8 correspond to the five-factor model. Columns correspond to the portfolio with no exclusion and the portfolios excluding the firms with the 10%, 25%, and 50% lowest scores. A "*" indicates that the parameter estimate is significant at the 5% level.

Table 9: Factor exposure of high dividend yield portfolios based on industry-adjusted average ESG score

	0% excl.	10% excl.	25% excl.	50% excl.		0% excl.	10% excl.	25% excl.	50% excl.
	Panel A: 3 FFF + Momentum					**Panel B: 5 FFF**			
World					**Developed countries**				
Ann. α	−2.85	−2.71	−2.81	−1.48	Ann. α	−5.72*	−5.29*	−4.44	−3.75
Market	1.11*	1.13*	1.14*	1.13*	Market	1.30*	1.30*	1.28*	1.24*
SMB	0.67*	0.57*	0.46*	0.32*	SMB	0.10	0.06	0.02	0.00
HML	0.36*	0.36*	0.30*	0.28*	HML	0.63*	0.62*	0.56*	0.57*
MOM	−0.06	−0.07	−0.09	−0.12	RMW	0.17	0.14	0.12	0.25
					CMA	−0.19	−0.19	−0.20	−0.22
The U.S.					**The U.S.**				
Ann. α	2.37	1.92	2.09	2.24	Ann. α	−0.40	−0.62	−0.43	−0.04
Market	0.82*	0.85*	0.84*	0.87*	Market	0.96*	0.98*	0.97*	0.98*
SMB	0.25*	0.27*	0.25*	0.19*	SMB	0.01	0.00	−0.01	−0.05
HML	0.42*	0.39*	0.36*	0.34*	HML	0.51*	0.49*	0.43*	0.47*
MOM	−0.09	−0.10	−0.09	−0.10	RMW	0.29	0.26	0.25	0.26
					CMA	−0.10	−0.14	−0.09	−0.21
Europe					**Europe**				
Ann. α	0.05	−0.11	0.41	0.36	Ann. α	−1.28	−1.58	−1.12	−1.53
Market	0.97*	0.99*	0.98*	0.97*	Market	1.02*	1.04*	1.03*	1.02*
SMB	0.34*	0.35*	0.27*	0.24*	SMB	−0.01	0.00	−0.03	−0.02
HML	0.18*	0.13*	0.13*	0.11*	HML	0.55*	0.50*	0.48*	0.46*
MOM	−0.15*	−0.17*	−0.14*	−0.15*	RMW	0.14	0.15	0.17	0.22
					CMA	−0.23	−0.17	−0.14	−0.07
Pacific					**Japan**				
Ann. α	2.94	3.20	3.32	3.56	Ann. α	6.32*	7.20*	7.73*	8.10*
Market	1.13*	1.10*	1.09*	1.11*	Market	0.94*	0.92*	0.91*	0.90*
SMB	0.49*	0.47*	0.41*	0.41*	SMB	−0.09	−0.11	−0.11	−0.13
HML	−0.39*	−0.38*	−0.37*	−0.39*	HML	0.14*	0.10	0.12	0.07
MOM	−0.19*	−0.18*	−0.21*	−0.20*	RMW	−0.31*	−0.37*	−0.32*	−0.32*
					CMA	−0.42*	−0.47*	−0.47*	−0.36*
Emerging countries									
Ann. α	3.60*	2.99	2.99	3.56					
Market	0.86*	0.85*	0.85*	0.86*					
SMB	0.15	0.13	0.08	0.03					
HML	0.25*	0.26*	0.17*	0.07					
MOM	−0.09	−0.10	−0.13*	−0.13*					

Note: The table reports summary statistics on high yield portfolios based on industry-adjusted average ESG score. Statistics are: the annualized alpha (in %) and the sensitivity to risk factors. Columns 1 to 4 correspond to the four-factor model; columns 5 to 8 correspond to the five-factor model. Columns correspond to the portfolio with no exclusion and the portfolios excluding the firms with the 10%, 25%, and 50% lowest scores. A "*" indicates that the parameter estimate is significant at the 5% level.

Table 10: Factor exposure of value portfolios based on industry-adjusted average ESG score

	0% excl.	10% excl.	25% excl.	50% excl.		0% excl.	10% excl.	25% excl.	50% excl.
	Panel A: 3 FFF + Momentum					**Panel B: 5 FFF**			
World					**Developed countries**				
Ann. α	1.97	2.26	2.73	2.78	Ann. α	4.51	4.53	3.21	3.78
Market	1.14*	1.11*	1.08*	1.11*	Market	1.21*	1.17*	1.18*	1.16*
SMB	0.65*	0.55*	0.58*	0.40*	SMB	0.23	0.17	0.17	0.21
HML	1.26*	1.24*	1.17*	1.02*	HML	1.72*	1.69*	1.53*	1.17*
MOM	−0.22*	−0.22*	−0.16*	−0.08	RMW	−0.71*	−0.67*	−0.56*	−0.49*
					CMA	−1.55*	−1.48*	−1.28*	−0.98*
The U.S.					**The U.S.**				
Ann. α	0.94	0.62	1.00	0.31	Ann. α	−1.22	−1.73	−1.23	−0.83
Market	1.01*	0.99*	0.97*	0.99*	Market	1.20*	1.20*	1.16*	1.15*
SMB	0.71*	0.71*	0.65*	0.66*	SMB	0.26*	0.26*	0.18	0.13
HML	0.72*	0.67*	0.60*	0.37*	HML	0.80*	0.73*	0.64*	0.53*
MOM	−0.18*	−0.17*	−0.12*	−0.17*	RMW	−0.12	−0.06	−0.02	−0.08*
					CMA	−0.41*	−0.37	−0.30	−0.36*
Europe					**Europe**				
Ann. α	1.38	1.07	1.08	0.96	Ann. α	1.69	0.52	−0.33	−0.49
Market	1.03*	1.03*	1.04*	1.00*	Market	1.08*	1.10*	1.11*	1.06*
SMB	0.54*	0.54*	0.54*	0.46*	SMB	0.03	0.06	0.11	0.05
HML	0.65*	0.58*	0.45*	0.37*	HML	1.20*	1.12*	0.98*	0.82*
MOM	−0.07*	−0.09*	−0.09*	−0.08*	RMW	−0.13	−0.03	0.12	0.15
					CMA	−0.78*	−0.60*	−0.42*	−0.34*
Pacific					**Japan**				
Ann. α	1.48	1.57	1.34	2.47*	Ann. α	5.13*	5.84*	5.66*	6.44*
Market	1.06*	1.03*	1.02*	1.01*	Market	1.09*	1.07*	1.04*	1.02*
SMB	0.62*	0.60*	0.61*	0.53*	SMB	−0.08	−0.09	−0.11	−0.19
HML	0.51*	0.49*	0.40*	0.29*	HML	0.44*	0.43*	0.43*	0.46*
MOM	−0.07*	−0.06*	−0.09*	−0.14*	RMW	−0.33*	−0.26*	−0.30*	−0.21
					CMA	−0.46*	−0.51*	−0.53*	−0.52*
Emerging countries									
Ann. α	1.29	0.03	−0.11	0.56					
Market	1.00*	1.00*	1.01*	0.97*					
SMB	0.16	0.15	0.14	0.26*					
HML	0.49*	0.51*	0.50*	0.33*					
MOM	−0.20*	−0.19*	−0.22*	−0.23*					

Note: The table reports summary statistics on value portfolios based on the industry-adjusted average ESG score. Statistics are: the annualized alpha (in %) and the sensitivity to risk factors. Columns 1 to 4 correspond to the four-factor model; columns 5 to 8 correspond to the five-factor model. Columns correspond to the portfolio with no exclusion and the portfolios excluding the firms with the 10%, 25%, and 50% lowest scores. A "*" indicates that the parameter estimate is significant at the 5% level.

Table 11: Factor exposure of quality portfolios based on industry-adjusted average ESG score

	0% excl.	10% excl.	25% excl.	50% excl.		0% excl.	10% excl.	25% excl.	50% excl.
	Panel A: 3 FFF + Momentum					**Panel B: 5 FFF**			
World					**Developed countries**				
Ann. α	1.57	0.81	0.78	1.58	Ann. α	1.16	0.55	0.89	1.40
Market	0.99*	0.99*	1.00*	0.97*	Market	1.05*	1.05*	1.05*	1.00*
SMB	0.24*	0.27*	0.27*	0.16*	SMB	0.10	0.12	0.06	0.05
HML	−0.27*	−0.32*	−0.35*	−0.28*	HML	−0.18*	−0.18*	−0.18*	−0.12
MOM	−0.11*	−0.11*	−0.13*	−0.11*	RMW	0.29*	0.36*	0.36*	0.30*
					CMA	0.00	−0.02	−0.03	−0.04
The U.S.					**The U.S.**				
Ann. α	1.36	1.02	1.03	1.47	Ann. α	0.66	0.12	0.22	0.85
Market	1.00*	0.99*	0.99*	0.99*	Market	1.07*	1.06*	1.05*	1.05*
SMB	0.46*	0.42*	0.39*	0.37*	SMB	0.12*	0.12*	0.09*	0.08
HML	−0.30*	−0.26*	−0.23*	−0.27*	HML	−0.11*	−0.08	−0.07	−0.08
MOM	−0.14*	−0.14*	−0.11*	−0.13*	RMW	0.22*	0.24*	0.21*	0.21*
					CMA	−0.07	−0.06	−0.04	−0.10
Europe					**Europe**				
Ann. α	1.98*	2.07*	1.86*	2.37*	Ann. α	2.00	2.03	1.77	2.14*
Market	0.95*	0.96*	0.98*	0.96*	Market	0.96*	0.97*	0.99*	0.96*
SMB	0.63*	0.61*	0.53*	0.51*	SMB	0.19*	0.19*	0.14*	0.15*
HML	−0.28*	−0.27*	−0.26*	−0.22*	HML	−0.17*	−0.17*	−0.19*	−0.12*
MOM	−0.07*	−0.06*	−0.05*	−0.03	RMW	0.15	0.16	0.15	0.19*
					CMA	−0.24*	−0.23*	−0.20*	−0.22*
Pacific					**Japan**				
Ann. α	3.05	2.59*	2.00	1.32	Ann. α	2.74	2.77*	2.55	2.57
Market	1.12*	1.10*	1.08*	1.09*	Market	1.00*	0.99*	1.00*	1.00*
SMB	0.28*	0.30*	0.29*	0.24*	SMB	−0.08	−0.08	−0.10*	−0.14*
HML	−0.46*	−0.43*	−0.36*	−0.35*	HML	−0.27*	−0.29*	−0.26*	−0.25*
MOM	−0.16*	−0.14*	−0.12*	−0.12*	RMW	−0.20*	−0.24*	−0.24*	−0.28*
					CMA	−0.31*	−0.30*	−0.34*	−0.43*
Emerging countries									
Ann. α	1.90	2.38	3.73*	5.98*					
Market	0.99*	0.98*	1.00*	0.99*					
SMB	0.20*	0.22*	0.18*	0.12					
HML	−0.23*	−0.23*	−0.32*	−0.19*					
MOM	−0.09*	−0.11*	−0.15*	−0.06					

Note: The table reports summary statistics on quality portfolios based on the industry-adjusted average ESG score. Statistics are: the annualized alpha (in %) and the sensitivity to risk factors. Columns 1 to 4 correspond to the four-factor model; columns 5 to 8 correspond to the five-factor model. Columns correspond to the portfolio with no exclusion and the portfolios excluding the firms with the 10%, 25%, and 50% lowest scores. A "*" indicates that the parameter estimate is significant at the 5% level.

Table 12: Factor exposure of momentum portfolios based on industry-adjusted average ESG score

	0% excl.	10% excl.	25% excl.	50% excl.		0% excl.	10% excl.	25% excl.	50% excl.
	Panel A: 3 FFF + Momentum					**Panel B: 5 FFF**			
World					**Developed countries**				
Ann. α	−1.84*	−1.40	−0.79	0.24	Ann. α	−3.25	−3.13	−3.26	−2.26
Market	1.10*	1.09*	1.07*	1.00*	Market	1.13*	1.13*	1.11*	1.06*
SMB	0.54*	0.45*	0.35*	0.24*	SMB	0.28	0.25	0.25	0.26
HML	0.23*	0.25*	0.29*	0.21*	HML	−0.67*	−0.68*	−0.61*	−0.53*
MOM	0.81*	0.79*	0.76*	0.58*	RMW	0.36	0.32	0.32	0.25
					CMA	0.47*	0.59*	0.56*	0.62*
The U.S.					**The U.S.**				
Ann. α	−0.90*	−0.65	0.37	0.38	Ann. α	−1.16	−1.18	−0.22	−0.17
Market	1.06*	1.05*	1.03*	1.03*	Market	1.06*	1.05*	1.02*	1.02*
SMB	0.62*	0.55*	0.50*	0.39*	SMB	0.14	0.13	0.14	0.08
HML	0.02	0.06	0.10*	0.01	HML	−0.38*	−0.34*	−0.26*	−0.25*
MOM	0.55*	0.54*	0.50*	0.39*	RMW	0.01	0.04	0.05	0.09
					CMA	0.11	0.14	0.09	0.10
Europe					**Europe**				
Ann. α	0.33	−0.02	0.81	1.76*	Ann. α	−0.17	−0.58	0.02	0.18
Market	1.01*	1.01*	1.00*	1.00*	Market	1.04*	1.04*	1.03*	1.04*
SMB	0.45*	0.44*	0.37*	0.37*	SMB	0.20*	0.17*	0.13	0.14*
HML	0.07*	0.06*	0.05*	0.01	HML	−0.32*	−0.33*	−0.30*	−0.32*
MOM	0.49*	0.47*	0.43*	0.38*	RMW	0.11	0.13	0.16	0.27
					CMA	0.27*	0.29*	0.30*	0.38*
Pacific					**Japan**				
Ann. α	0.53	0.06	0.91	1.21	Ann. α	−2.16	−2.39	−2.01	−1.71
Market	0.98*	0.98*	0.96*	0.95*	Market	1.00*	1.00*	1.00*	0.98*
SMB	0.32*	0.38*	0.35*	0.32*	SMB	0.17*	0.15	0.16*	0.13
HML	0.02	0.02	0.04	0.05	HML	−0.07	−0.07	−0.06	−0.04
MOM	0.50*	0.47*	0.45*	0.45*	RMW	0.19	0.22	0.25	0.24
					CMA	0.42*	0.45*	0.47*	0.43*
Emerging countries									
Ann. α	2.92	2.66	2.70	3.67*					
Market	0.98*	0.96*	0.96*	0.96*					
SMB	0.19*	0.18*	0.17*	0.01					
HML	−0.04	−0.07	−0.10	−0.06					
MOM	0.40*	0.38*	0.34*	0.34*					

Note: The table reports summary statistics on momentum portfolios based on the industry-adjusted average ESG score. Statistics are: the annualized alpha (in %) and the sensitivity to risk factors. Columns 1 to 4 correspond to the four-factor model; columns 5 to 8 correspond to the five-factor model. Columns correspond to the portfolio with no exclusion and the portfolios excluding the firms with the 10%, 25%, and 50% lowest scores. A "*" indicates that the parameter estimate is significant at the 5% level.

Figure 1: Coverage of the regional MSCI standard indexes by firms with an ESG score

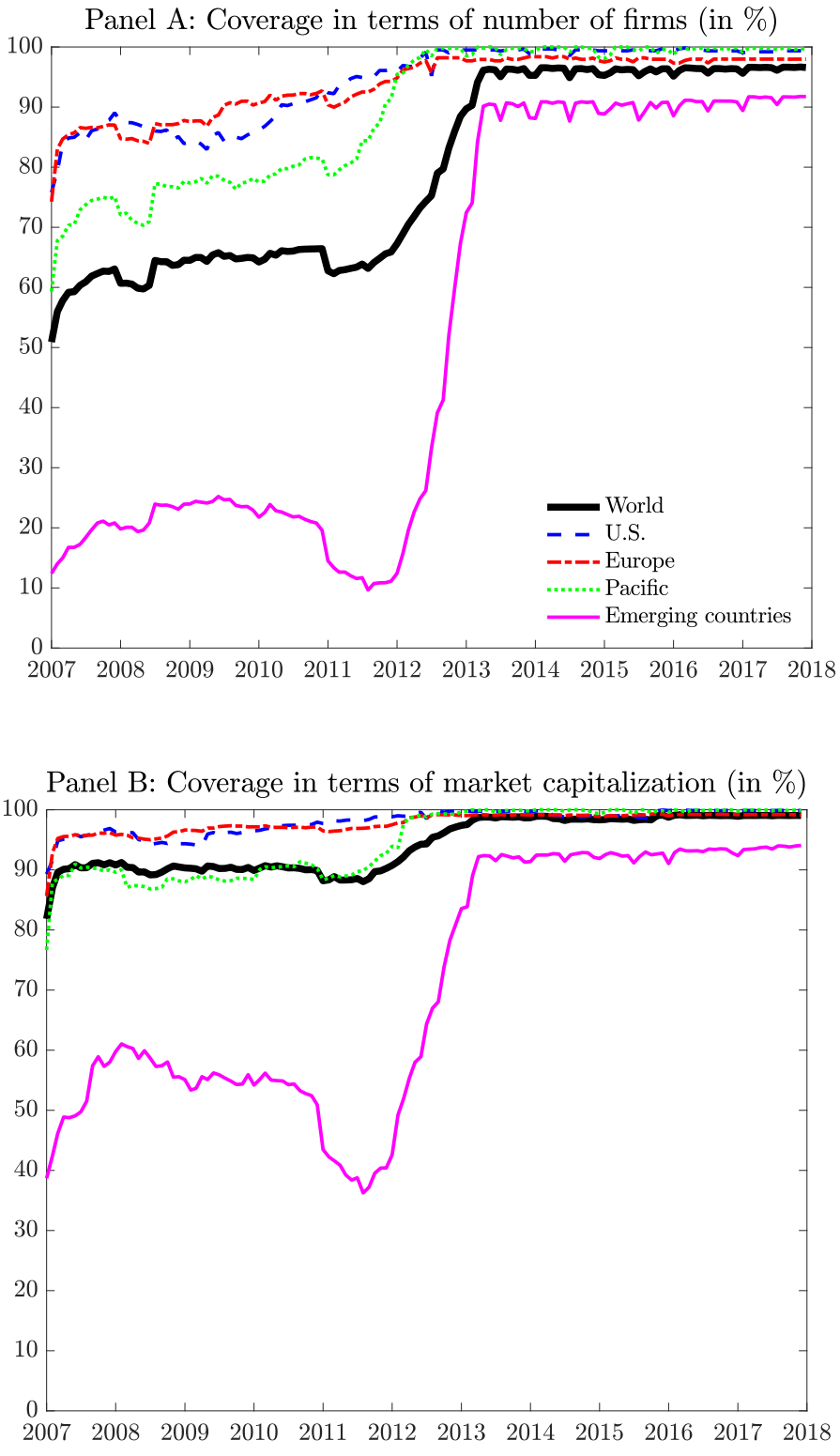


Figure 2: Evolution of the average score for different regions and different ESG criteria

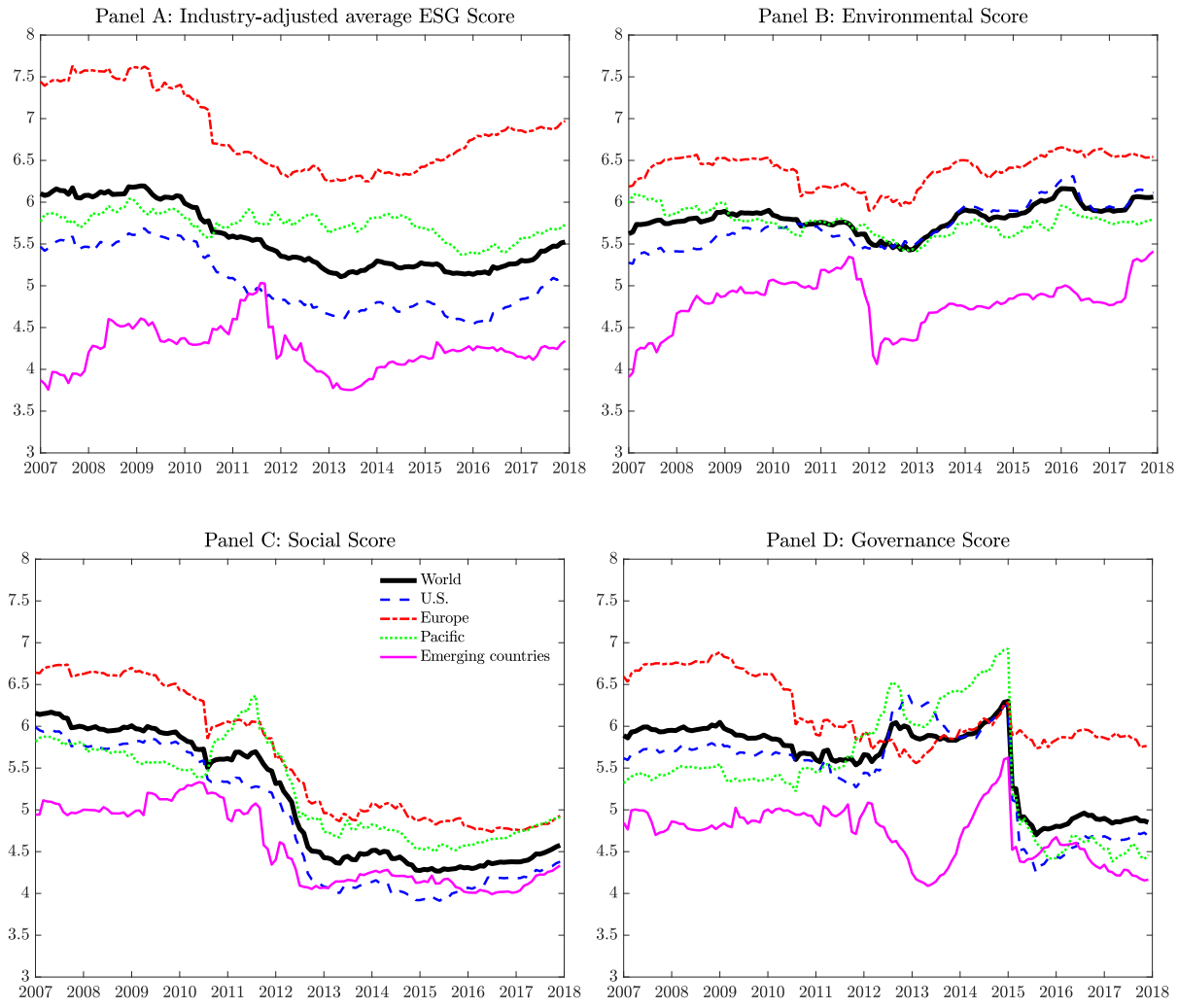


Figure 3: Evolution of the industry-adjusted average ESG score for industries

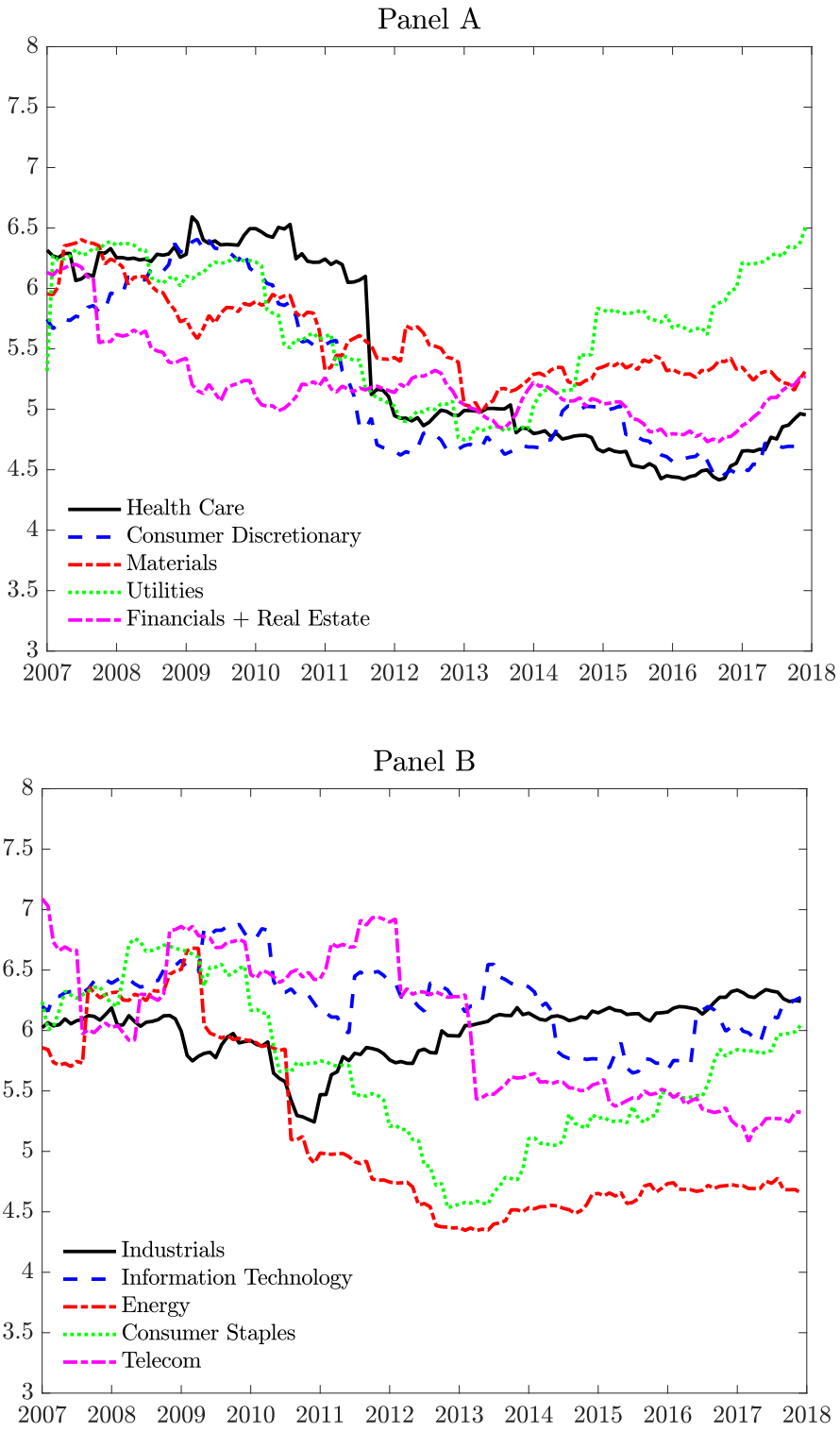


Figure 4: Weight of some regions in the MSCI ACWI standard benchmark portfolio and in portfolios with different levels of ESG screening

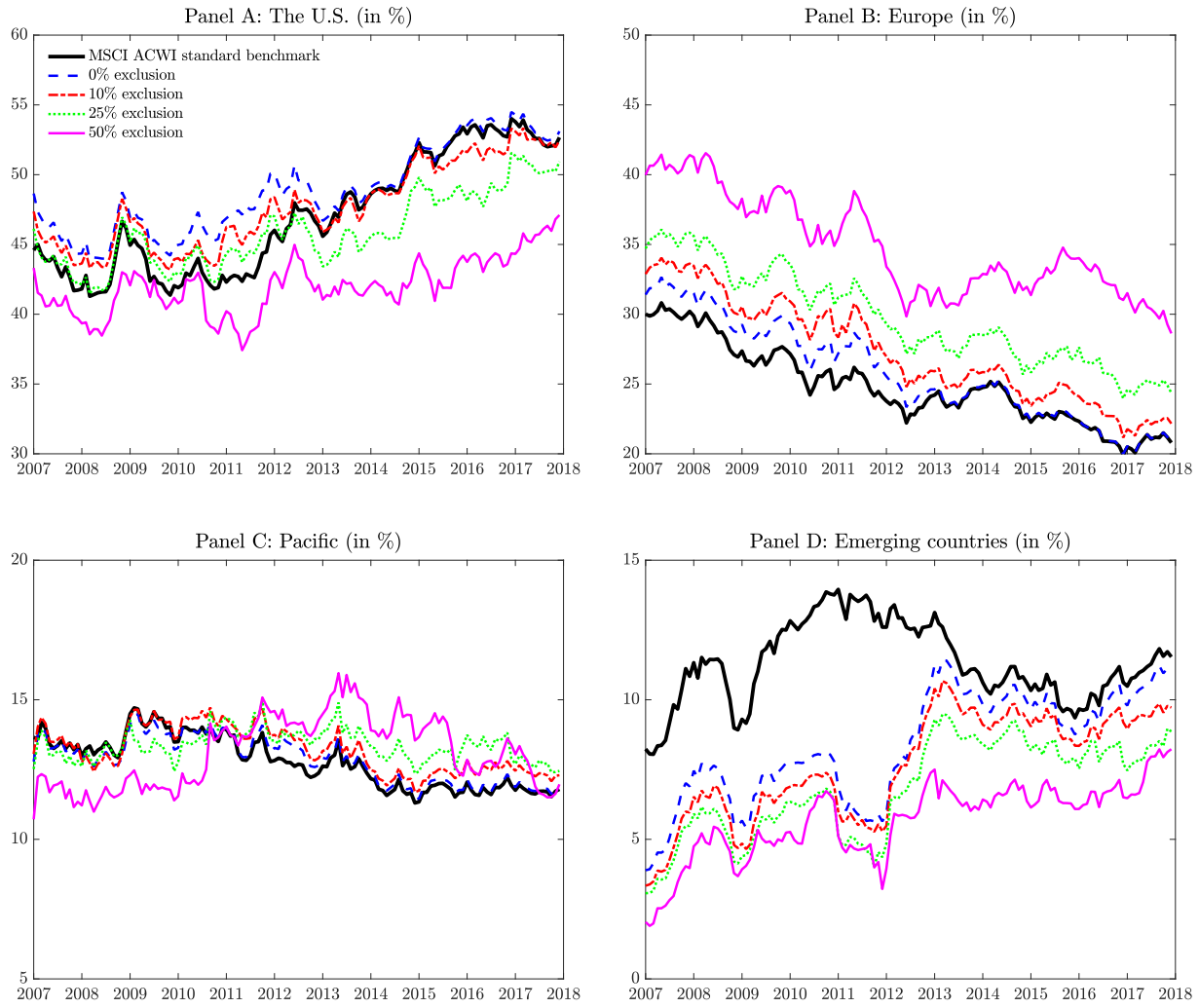
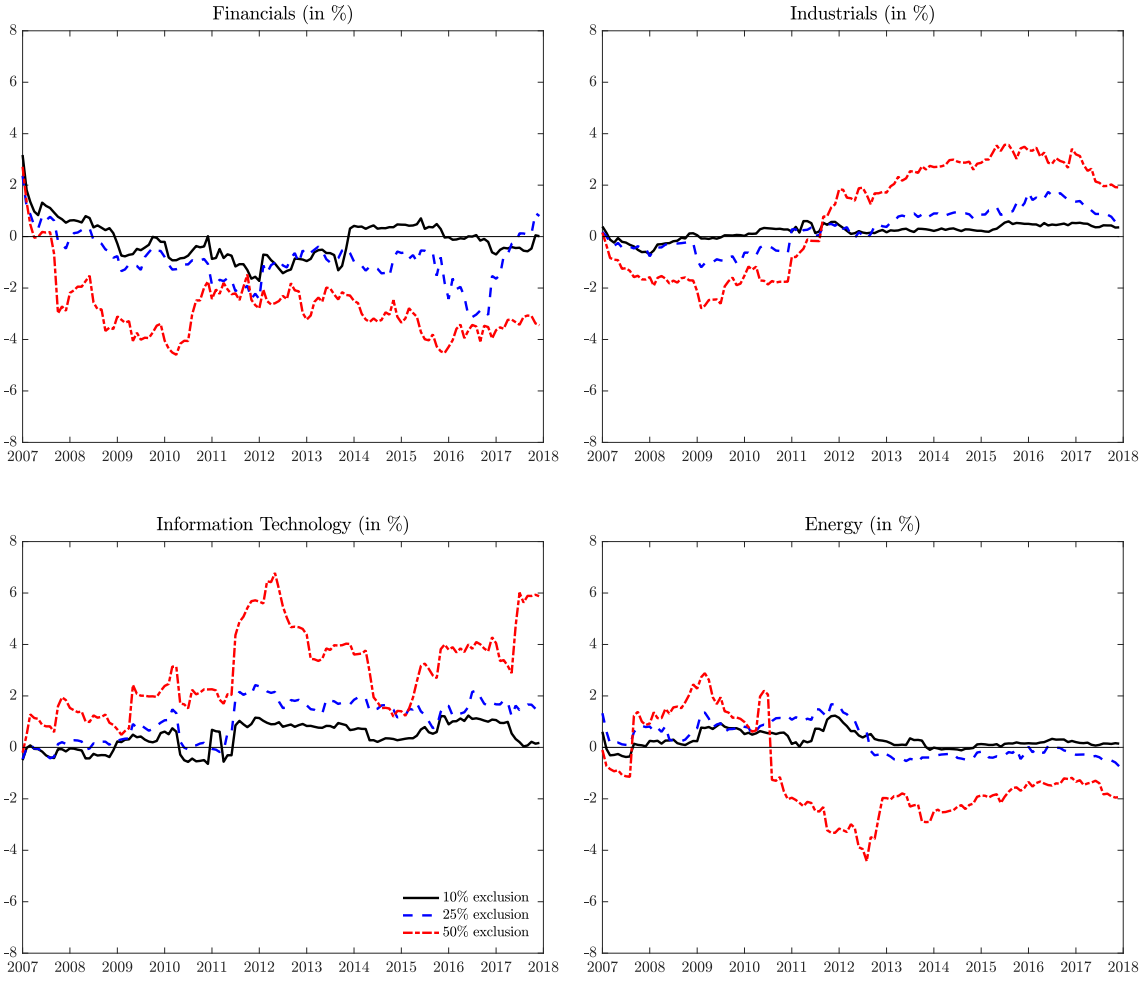


Figure 5: Weight of some industries in portfolios with different levels of ESG screening relative to the MSCI ACWI standard benchmark portfolio

Panel A: Industry-adjusted average ESG score portfolio



Panel B: Environmental portfolio

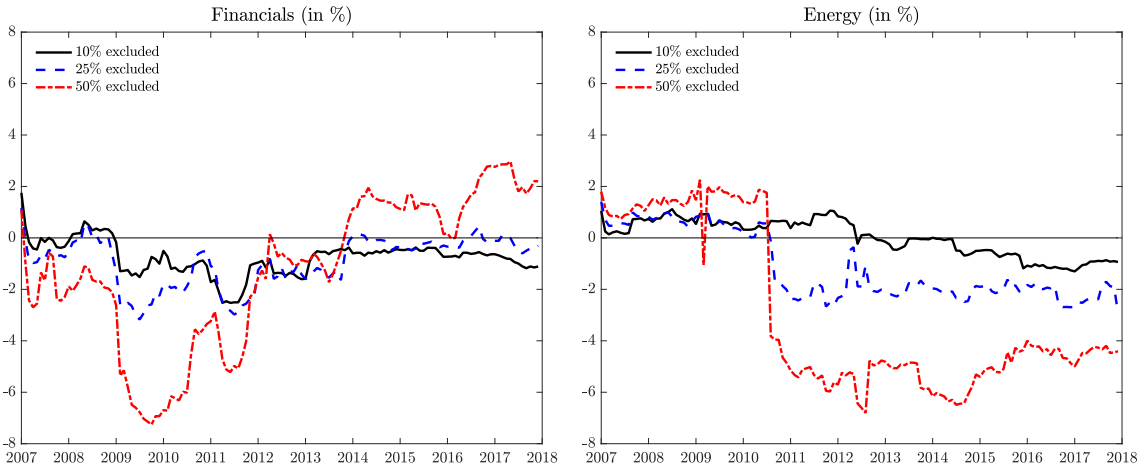


Figure 6: Performance of size portfolios based on industry-adjusted average ESG score

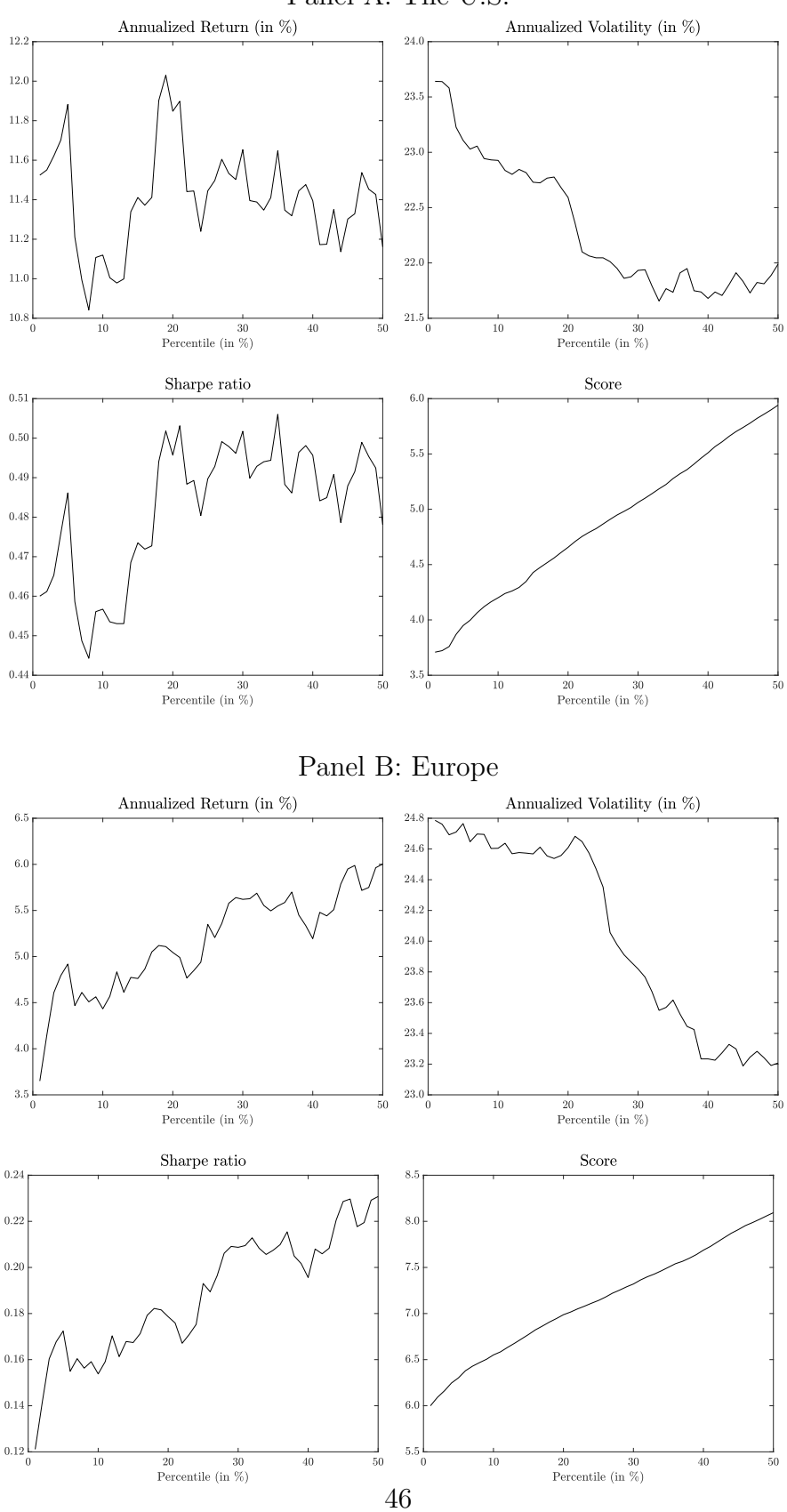


Figure 7: Performance of momentum portfolios based on industry-adjusted average ESG score

