INTERNATIONAL MONETARY FUND

Deconstructing ESG Scores: How to Invest with your own Criteria?

Torsten Ehlers (IMF), Ulrike Elsenhuber (BIS), Anandakumar Jegarasasingam (BIS), and Eric Jondeau (University of Lausanne)

WP/23/57

IMF Working Papers **describe research in progress by the author(s) and are published to elicit comments and to encourage debate.**

The views expressed in IMF Working Papers are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

2023
MAR

WORKING PAPER

© 2023 International Monetary Fund WP/23/57

IMF Working Paper

Monetary and Capital Market Department

Deconstructing ESG Scores: How to Invest with your own Criteria?

Prepared by Torsten Ehlers, Ulrike Elsenhuber, Anandakumar Jegarasasingam, and Eric Jondeau

Authorized for distribution by Prasad Ananthakrishnan

March 2023

***IMF Working Papers* describe research in progress by the author(s) and are published to elicit comments and to encourage debate.** The views expressed in IMF Working Papers are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

ABSTRACT: Environmental, Social, and Governance (ESG) scores are a key tool for asset managers in designing and implementing ESG investment strategies. They, however, amalgamate a broad range of fundamentally different factors, creating ambiguity for investors as to the underlying drivers of higher or lower ESG scores. We explore the feasibility and performance of more targeted investment strategies based on specific ESG categories, by deconstructing ESG scores into their granular components. First, we investigate the characteristics of the various categories underlying ESG scores. Not all types of ESG categories lend themselves to more focused strategies, which is related to both limits to ESG data disclosure and the fundamental challenge of translating qualitative characteristics into quantitative measures. Second, we consider an investment scheme based on the exclusion of firms with the lowest scores in a given category of interest. In most cases, this strategy allows investors to substantially improve the ESG category score, with a marginal impact on financial performance relative to a broad stock market benchmark. The exclusion results in regional and sectoral biases relative to the benchmark, which may be undesirable for some investors.We then implement a “best-in-class” strategy by excluding firms with the lowest category scores and reinvesting the proceeds in firms with the highest scores, maintaining the same regional and sectoral composition. This approach reduces the tracking error of the portfolio and slightly improves its risk-adjusted performance, while still yielding a large gain in the targeted ESG category score.

JEL Classification Numbers:	G11, G24, M14, Q01
Keywords:	Sustainable investment; ESG ratings; ESG investing; Negative screening; Best-in-class screening
Authors’ E-Mail Addresses:	TEhlers@imf.org, Ulrike.Elsenhuber@bis.org, Kumar.Jegarasasingam@bis.org, Eric.Jondeau@unil.ch.

Executive Summary

Environmental, social and governance (ESG) scores are becoming an increasingly important tool for asset managers to design and implement ESG investment strategies. However, there are drawbacks in using headline ESG scores that limit their usefulness. ESG scores amalgamate a broad range of fundamentally different factors, which creates ambiguity. Weak scores in one pillar can offset strong scores in another pillar.

We demonstrate an investment strategy based on deconstructing ESG scores. The strategy focuses on specific underlying ESG categories such as emissions reduction and human rights. To implement our investment strategy, we exclude firms with the lowest scores in certain ESG categories of interest and implement a best-in-class investment strategy.

This approach helps investors overcome the "aggregated confusion" inherent in ESG scores. Moreover, it enables investors to better track the sustainability performance trajectory of their portfolio against their stated sustainable investment objectives.

We find that simple exclusions enable substantial improvements to the headline ESG score of the portfolio. Here, the portfolio's financial performance only suffers a marginal impact relative to a broad stock market benchmark. However, the exclusion results in regional and sectoral biases compared to the benchmark.

To counter this, we adopt a best-in-class strategy that excludes firms with the lowest category scores and reinvests the proceeds in firms with the highest scores. This approach helps reduce the tracking error of the portfolio, and slightly improve its risk adjusted performance while still yielding a large gain in the headline ESG score.

Deconstructing ESG Scores: How to Invest with your own Criteria?*

Torsten Ehlers, Ulrike Elsenhuber,

Anandakumar Jegarasasingam, and Eric Jondeau

March 2023

Abstract

Environmental, Social, and Governance (ESG) scores are a key tool for asset managers in designing and implementing ESG investment strategies. They, however, amalgamate a broad range of fundamentally different factors, creating ambiguity for investors as to the underlying drivers of higher or lower ESG scores. We explore the feasibility and performance of more targeted investment strategies based on specific ESG categories, by deconstructing ESG scores into their granular components. First, we investigate the characteristics of the various categories underlying ESG scores. Not all types of ESG categories lend themselves to more focused strategies, which is related to both limits to ESG data disclosure and the fundamental challenge of translating qualitative characteristics into quantitative measures. Second, we consider an investment scheme based on the exclusion of firms with the lowest scores in a given category of interest. In most cases, this strategy allows investors to still substantially improve the ESG category score, with only a marginal impact on financial performance relative to a broad stock market benchmark. The exclusion results in regional and sectoral biases relative to the benchmark, which may be undesirable for some investors. We then implement a "best-in-class" strategy by excluding firms with the lowest category scores and reinvesting the proceeds in firms with the highest scores, maintaining the same regional and sectoral composition. This approach reduces the tracking error of the portfolio and slightly improves its risk-adjusted performance, while still yielding a large gain in the targeted ESG category score.

JEL: G11, G24, M14, Q01

Keywords: Sustainable investment, ESG ratings, ESG investing, Negative screening, Best-in-class screening

*We would like to thank Raphael Auer, Claudio Borio, Stijn Claessens, Enisse Kharoubbi, Luiz Pereira da Silva, Murphy Phan and participants to a webinar held at the BIS, and German Villegas Bauer, Florence Jaumotte, Divya Kirti, Augustus Panton, and Felix Suntheim, and IMF webinar participants for useful comments and suggestions. T. Ehlers: International Monetary Fund, Washington, D.C., United States (e-mail: TEhlers@imf.org). U. Elsenhuber: Bank for International Settlements, Aeschenplatz 1, 4051 Basel, Switzerland (e-mail: Ulrike.Elsenhuber@bis.org). A. Jegarasasingam: Bank for International Settlements, Centralbahnplatz 2, 4051 Basel, Switzerland (e-mail: Kumar.Jegarasasingam@bis.org). E. Jondeau: University of Lausanne, Enterprise for Society (E4S) Center, and Swiss Finance Institute, Faculty of Business and Economics (HEC Lausanne), Extranef 232, CH-1015 Lausanne, Switzerland (e-mail: Eric.Jondeau@unil.ch). The views expressed in this paper are those of the authors and do not necessarily reflect those of the International Monetary Fund or the Bank for International Settlements.

1 Introduction

Environmental, Social and Governance (ESG) investing has enjoyed rapid growth and by some measure has already reached $35 trillion – more than one third of global total assets under management (GSIA, 2020). Further rapid growth is expected, as ESG funds' assets under management could exceed $50 trillion by 2025 (Bloomberg, 2021). This trend presents an opportunity for investment managers, and potentially for society as a whole.

ESG scores are a key tool for implementing investment managers' ESG strategies (Amel-Zadeh and Serafeim, 2021). Among the most popular strategies are ESG integration, which employs ESG factors alongside financial factors for portfolio selection, and negative screening, whereby assets with the worst (or "worst-in-class") ESG characteristics are excluded. Typically, investment managers rely on ESG scores by one or several data providers to measure ESG performance. ESG scores therefore are central to ESG investing and, by extension, to a substantial and rising share of investment allocations globally. The use of ESG scores faces some well-known challenges, however. One key challenge for investment managers is the very low correlation of scores between the different major data providers. Investment managers may thus arrive at different portfolio selections using the same strategy but different ESG data providers. While the correlation between credit ratings is usually close to 99%, Berg *et al.* (2019) find that on average the correlation between ESG ratings is only slightly above 50%.

In this paper, we take an investment manager perspective and aim to circumvent the inconsistencies of ESG scores by deconstructing them and focusing on the underlying data points. Our main question is: Can an investment manager construct a portfolio of equities (from a broad investable universe) that achieves a given financial performance, but with better underlying ESG characteristics? Cutting straight through to the underlying characteristics not only circumvents potential inconsistencies of ESG scoring and weighing methods, but also affords asset managers the flexibility to focus on specific aspects within the ESG sphere, mitigating the ambiguity that the amalgamation of a large set of diverse ESG factors inherently creates.[1] Achieving given risk-return characteristics isolates the effect of implementing different degrees of ESG screening. More importantly, it also

[1] In a survey of 26 portfolio managers with more than $16 trillion of assets under management, IMF (2021) reports that 82% of respondents use third-party ESG databases as an input of their investment process. In addition, respondents were often skeptical about the reliability and comparability of aggregate scores and preferred using raw metrics.

resembles the problem that many large investors are facing in implementing their ESG strategy, who typically first screen for equity funds that match their desired financial performance. Indeed, for most investment funds, the primary mandate remains financial performance, while ESG considerations must either support or be neutral to the primary mandate.

To define the scope of the analysis, we naturally have to make a few fundamental choices. The first is the scope of underlying ESG data points. Our analysis uses Refinitiv (formerly Thomson Reuters Asset4) data, which is one of the few major ESG data provider that makes the underlying data points publicly available.[2] We use all ESG data points (186 comparable measures), Refinitiv uses to define ten ESG categories, which are then combined to the three E, S, and G pillars. The second choice is the set of underlying ESG characteristics of interest. This choice is naturally subjective and would depend on the desired ESG scheme of an investment manager. In our analysis, we consider the ESG categories in the Refinitiv dataset, which are likely representative of the thematic objectives investment managers may want to implement. The third choice is design of the investment strategy. We assume an institutional investor who is otherwise passive, i.e., who carefully tracks the composition of an internationally diversified benchmark and evaluates her performance relative to this benchmark. The constituents of the benchmark therefore span our universe of investable assets. We take a very broad equity index as our benchmark – the MSCI All Country World Index (ACWI) – to show the general geographical and sectoral applicability of our results. Choosing a broad benchmark index is possible given the broad coverage of listed firms in the Refinitiv ESG data.

Two challenges relating to how ESG data is disclosed and recorded are the treatment of missing data and the translation of qualitative information into a numeric value. As a general principle, numeric data points (e.g., annual CO_2 emissions in tons) are better suited for a screening investment strategy, as they enable a sharper distinction between firms. However, such distinction is not truly possible when firms fail to disclose the related information. The reason is that in the case of a missing value, the data point then assigned is the same value as if the firm had scored poorly on the specific indicator. Boolean questions, on the other hand, only allow for a limited differentiation between

[2]Recently, another major data provider – Sustainalytics – has started to make the underlying data points publicly available. The time series dimension of this data (annual data since 2018), however, is not long enough for the purposes of the analysis in this paper.

firms if many or all of the underlying ESG data points of interest are logical values.[3] As a result of both of these issues, screening strategies are only well suited for ESG strategies where the degree of acceptable exclusion is sufficiently high, as Boolean data points can be heavily skewed towards a missing or zero value. While to some degree these challenges are specific to the data we use (in the Refinitiv ESG data, missing and zero values are indistinguishable), they nevertheless point to more general issues regarding the disclosure and numeric representation of ESG data.

Our key result is that constructing a portfolio with an ESG objective based on underlying ESG data points comes at virtually no costs in terms of financial performance. Investment managers can construct portfolios with specific ESG benefits, without relying on potentially confounding ESG scores, while still being able to match a given desired financial performance. For instance, with the 33% screening threshold, the portfolio score improves by 18 pp (percentage points) on average across ESG categories (from 62 to 80, with a maximum possible score equal to 100), while the increase is equal to 11 pp only when the overall ESG score is targeted. The screening process has a substantial impact on regional and sectoral exposures of the portfolio, which an otherwise passive investor may not be able to accept. Therefore, we implement a "best-in-class" strategy by excluding firms with the lowest scores and reinvesting the proceeds in firms with the highest scores in the same region-sector. The scores associated with this strategy improve slightly, while the portfolios have the same regional and sectoral exposures as the benchmark. The main cost of the screening strategy is the tracking error relative to the MSCI ACWI, although most of this cost comes from the use of an intermediary benchmark (based on the constituents of the index with an ESG score): The tracking error of this benchmark relative to the MSCI ACWI is on average equal to 0.9% per year. The additional cost due to the screening is below 0.7% per year even with a 33% screening threshold.

Related Literature. Our paper is related to the literature that investigates quality issues in ESG data. As the development of ESG ratings is relatively recent, there is a rather large discrepancy between ESG ratings produced by different data providers, raising issues about their reliability and comparability. Berg *et al.* (2019) identify three sources of divergence in ESG ratings (due to divergence in scope, in measurement, and in

[3]For instance, the database contains 95% of zeros associated with the question "Does the company provide information about the total individual compensation of all executives and board members?"

weights) and find that differences in measurement explain most of the differences between ESG ratings, meaning that the same ESG attribute is measured using different underlying indicators. Gibson *et al.* (2021), Billio *et al.* (2021), and Serafeim and Yoon (2021) analyze the disagreement across data providers and evaluate its impact on future stock returns. High disagreement regarding the ESG quality of a firm tends to be associated with a lower subsequent stock return. Berg *et al.* (2020) document large and repeated changes in the historical ESG scores. While they find a positive relation between ESG scores and stock returns when updated data are used, the authors do not observe such a relationship with the initial data. Sahin *et al.* (2021) document the large proportion of missing information, which makes the reliability of ESG scores questionable.

Finally, we build on the literature on ESG investing and its financial performance, which has grown very rapidly, as demonstrated by Friede *et al.* (2015). For a long time, firms with low ESG scores and "sin stocks" were expected to enjoy superior performance (Fabozzi *et al.*, 2008 and Hong and Kacperczyk, 2009). Recent analysis has also been spurred by the financial outperformance of firms with high ESG scores during the great financial crisis (Lins *et al.*, 2017) as well as the COVID-19 shock (Garel and Petit-Romec, 2021), although there is some evidence also to the contrary (Demers *et al.*, 2021, Pástor *et al.*, 2022, Scatigna *et al.*, 2021). One possible explanation for these diverging research conclusions is the heterogeneity and inconsistency of data, including diverging imputation methods employed in ESG scoring to address data gaps (Kotsantonis and Serafeim, 2019). Deconstructing ESG scores into their individual elements is aimed at shedding light on this discussion.

Depending on their preferences, investors may be willing to trade off financial returns for non-financial benefits. Bonnefon *et al.* (2022) distinguish between two main views of investors' ethical preference: "value-alignment" investors who have an aversion against companies that do not operate in line with investors' own values; and "impact-seeking" investors who value investment that generate a positive societal impact. In this paper, we assume that institutional investors caring about ESG characteristics are overwhelmingly interested in value alignment. While impact investing is gaining traction, it is still a niche and usually not within the mandate of institutional investors (IFC, 2021).

Further, ESG scores are an imperfect measure of impact. Elmalt *et al.* (2021), for instance, find that the ESG score (and the E score) does not capture differences across firms

in their carbon emissions. ESG investing, on the other hand, is closer to value-alignment and ESG scores represent a way to compress a broad number of factors predominantly reflective of moral and social values into a single numeric measure. In equilibrium, ESG screening should result in lower expected returns for firms with high ESG scores if investors have preferences for firms with high ESG quality. Pedersen *et al.* (2021) propose the concept of an ESG-efficient frontier – the highest attainable Sharpe ratio for each ESG level. Conceptually, the approach in this paper attempts to maximize the ESG level, while keeping the performance of the portfolio as close as possible to that of a diversified benchmark. Pástor *et al.* (2021) obtain that in an equilibrium model with ESG preferences, green assets have negative alphas and brown assets positive alphas. However, as pointed out by Pástor *et al.* (2022), green assets have delivered higher *realized returns* in the recent period because of the demand pressure driven by investors' climate concerns.

The remainder of the paper is structured as follows. Section 2 describes our data. In Section 2.3, we present the main results regarding the disclosure of ESG information by firms. Section 3 summarizes the main results for the portfolio screening. Section 4 concludes.

2 Data

2.1 Construction of the Scores

The methodology adopted by Refinitiv for scoring firms is relatively complex, as it combines a vast amount of different types of data and different aggregation schemes (see Refinitiv, 2021). At the same time, it is strongly data-driven and transparent – not least due to the disclosure of both the underlying methodology and data points. First, the database is based on 450 data points (or metrics), which can be Boolean indicators and numeric indicators, such as ratios and analytics. Of these 450 metrics, 186 comparable measures are actually used for the ESG scoring. Other data points cover different topics of interest but are not directly used for the ESG scoring. The 186 comparable measures are then aggregated, using different weightings, into 10 categories. The 10 categories, in turn, are aggregated further to compute the three (E, S, and G) pillars.

The definition and characteristics of the pillars and categories are summarized in the

table below (Refinitiv, 2021). ESG pillar scores are obtained by multiplying category scores with their category weights. For the E and S pillars, category weights vary across industries depending on the materiality of the associated indicators.[4] Some indicators are material for some industries but are not included in the calculation of the scores for the other industries.[5] For the G pillar, the weights of the three categories are the same across all industries, as indicated in the table. The overall ESG score is based on combining the three pillars, with weights that are specific to the industry of the assessed firm. All scores are between 0 and 100, with 100 being the best possible score.

Pillars and categories	Nb of comparable measures	Themes
Environmental		
(1) Emission reduction	28	Emissions; Waste; Biodiversity; Environmental management systems
(2) Innovation	20	Product innovation; Green revenues, research and development and capital expenditures
(3) Resource use	20	Water; Energy; Sustainable packaging; Environmental supply chain
Social		
(1) Community	10	Public health; Business ethics
(2) Human rights	8	Respect of fundamental human rights conventions
(3) Product responsibility	30	Responsible marketing; Product quality; Data privacy
(4) Workforce	14	Diversity and inclusion; Career development and training; Working conditions; Health and safety
Governance (weight)		
(1) CSR strategy (0.13)	12	Corporate Social Responsibility strategy; ESG reporting and transparency
(2) Management (0.67)	9	Structure (independence, diversity, committees); Compensation
(3) Shareholders (0.20)	35	Shareholder rights; Takeover defenses

[4] In the Refinitiv ESG data, for each industry, the materiality of a category is determined as follows: for each theme a metric with sufficient disclosure is used to gauge the importance of the theme for the industry. For a Boolean metric, the materiality weighting is based on the proportion of disclosure relative to other industries, using a decile ranking ranging from 1 to 10. For a numeric indicator, the materiality weighting is based on the median value of the metric in the industry relative to other industries, again using a decile ranking from 1 to 10. The weights for each industry are then normalized to add up to 1. See Refinitiv (2021) for details.

[5] For instance, for the coal industry, the weights to compute the E pillar score are equal to 0.20 for Emission reduction, 0.19 for Resource use, and 0.02 for Innovation, reflecting the materiality of the first two categories for this industry. In contrast, for banking services, the weights are equal to 0.02, 0.02, and 0.10, respectively.

An important aspect of the Refinitiv database is the data collection process. For the list of firms covered by Refinitiv, analysts collect information over individual ESG measures using numerous publicly available sources (including annual reports, CSR reports, company website, or news sources). Essentially, the data collected by Refinitiv reflect the disclosure policy of the firms, except for some particular situations such as controversies, which also reflect reports from global media.[6]

The Refinitiv database is unique and highly suitable for economic analyses for two reasons. First, it provides the 186 comparable measures used to calculate the 10 category scores. These data points allow us to identify what generates the particular distribution of the category scores, as we detail in Section 2.3. Second, the methodology used to build the scores is transparent, which also allows us to precisely interpret the scores. One challenging aspect, which we explain in Section 2.3.2, is the methodological choice to assign a default value to a Boolean indicator when no relevant data is found in the public disclosure of a firm. The default value is 0 when answering 'yes' to the question is positive from a sustainability point of view (e.g., "Does the firm conduct corporate social responsibility reporting?") but 1 when answering 'yes' is negative (e.g., "Is the structure of the company board classified?").

2.2 Data Coverage

We use all data available in Refinitiv database, from 2010 to 2019. Our analysis of ESG data ends in 2019 for two reasons. First, there is a substantial time lag for a complete update of the database for a given financial year. At the time of our last download (March 2021), some data were already available for 2020, but for a substantial number of firms the data was still missing. Second, as we describe in Section 3, we evaluate the financial performance of a portfolio built at the end of year t using stock returns in year $t+1$, so that the performance of the portfolio built with 2019 data is based on financial returns at the end of 2020. Our sample is defined as the complete set of firms included in the

[6]Refinitiv database is not without drawbacks. One particular problem is the widespread and repeated changes to the historical ESG scores. As data in Refinitiv database are subject to backward changes of up to five years as new information is disclosed, changes to the historical data are relatively likely, as put forward by Berg *et al.* (2020). These authors find that the median ESG score in the rewritten data are 18% lower than in the initial data, with a deviation of 44% for the E score. In early 2021, Refinitiv opened a portal for firms to submit their ESG data, though this does not apply to our sample period, which runs up to the fiscal year ending in 2019 for the firms covered by Refinitiv. See https://www.refinitiv.com/en/media-center/press-releases/2021/january/refinitiv-makes-esg-company-scores-free-rolls-out-esg-voice-app.

Refinitiv database for which a market capitalization is available in a given year. At the time of our last download, the database contains 10,142 firms that have been evaluated at some point in time.

Table 1 reports summary statistics on the number of firms for which both market capitalization and ESG scores are available. All numbers in the table are relative to the firms covered by Refinitiv ESG in 2020: The total number of firms worldwide in the database is 10,142 as of 2020 – the latest available data at the time of analysis. The proportion of firms with available market capitalization in 2010 was equal to 74.8%. Among these 7,590 firms, 3,911 (51.5%) also have a Refinitiv ESG score in the respective year. The proportion of firms with an ESG score remains fairly stable in our sample until 2014, at slightly above 50% of the firms in the database. Starting in 2015, the coverage improves steadily, with a maximum in 2019, with 82.3% of firms in our sample. In general, other scores (3 pillars and 10 categories) have a coverage that is essentially the same as the aggregate ESG score.

In 2019, the regional coverage in terms of market capitalization is the following: 39% of firms are from North America, 20% from Europe, 14% from the Pacific, 23% from Emerging countries. The table also reveals that among the list of firms in the Refinitiv database, the proportion of firms with ESG scores varies substantially across regions. On average, it is relatively low in North America at the beginning of the sample, below 50% until 2014. In Emerging countries, the proportion of firms with an available ESG score is above 50% since 2011. In Europe and the Pacific, the ESG score coverage is relatively complete over the full sample.

[Insert Table 1 here]

2.3 Disclosure of ESG Information

In this section, we analyze the disclosure of ESG data by firms in the Refinitiv database. As discussed in the introduction, there is currently no generally agreed regime for ESG-type disclosures. We present the two issues raised by ESG data (missing values in numeric indicators and proportion of zeros in Boolean indicators) and describe the implications for category scores.

2.3.1 Missing Values in Numeric Indicators

For numeric indicators, a score (based on the relative percentile ranking) is calculated only if the firm has reported this information and a missing value is assigned when Refinitiv cannot find the information in publicly available reports. To compute the proportion of valid (or non-missing) values for a given numeric indicator in a given year, we start by calculating the number of firms for which a given indicator is available in that year; then, for this given indicator, we identify the industries for which the indicator is material. Finally, we calculate the number of firms with valid data in these industries and divide by the total number of firms in these industries.

Table 2 (Panel A) reports summary statistics on the proportion of valid values for numeric indicators, for each pillar and category, which we interpret as a proxy for the disclosure policy of the firms. Overall, the proportion of valid values is relatively low, close to 40% on average for all numeric indicators over the sample. In fact, there is a large gap between the E and S pillars (20% and 30%) and the G pillar (80%). Within a given pillar, this proportion is usually homogeneous. Indicators related to Emission reduction have a proportion of valid values equal to 22% worldwide on average. These results reveal the lack of disclosure, in particular regarding measures taken by firms to protect the environment (approximately 10% of firms provide data on their Renewable energy use ratio) or to reduce greenhouse gas emissions (25% of firms report data on their CO_2 equivalent Scope 3 indirect emissions). The proportion of valid values is particularly low for the Innovation category in the E pillar and the Product responsibility in the S pillar (close to 10% on average worldwide).[7]

[Insert Table 2 here]

2.3.2 Proportion of Zeros at Category Level

Boolean indicators usually do not have missing values in the Refinitiv database. When the information concerning a Boolean question is not available, Refinitiv assigns a value equal to 0 (corresponding to a 'no') when answering the question with 'yes' would be considered positive and to 1 (corresponding to a 'yes') when answering the question with 'yes' would be considered negative. This strategy of penalizing firms is relatively recent.

[7] Additional results are provided in Technical Appendix A on missing values, with a breakdown by regions, industries, and sizes.

As stated on the Refinitiv website, "the previous ESG scoring methodology allocated a score of 0.5 to companies which did not report on metrics, essentially giving them the 'benefit of the doubt'. However, as this may disincentivize companies to report on their ESG performance, the enhanced methodology assigns a score of zero to companies who don't report on metrics relevant to the industry. This new approach encourages company disclosure and transparency."[8] We note that this methodological choice would incentivize companies to improve their nonfinancial information disclosure if they actually improve their policy.

Because of the choice to assign a value of 0 to missing Boolean indicators, the proportion of valid values is equal to 100% for most categories. However, one difficulty with assigning the same value of 0 to both negative answers and missing values is that the evolution of the indicator over time may be difficult to interpret. For instance, if we consider the question "Does the company have a policy to avoid the use of forced labor?", we find that the number of 0 has decreased from 95% in 2010 to 52% in 2019. However, we cannot identify if this change is due to a better reporting or to a real improvement in firms' policy.

An implication of this approach is that the proportion of firms with a value of 0 is very large for some Boolean indicators. For instance, in 2019 the proportion of 0 is equal to 74% for the reporting on firm's environmental expenditures and to 95% for the reporting about the total individual compensation of all executives and board members. When we turn to category scores, this attribution approach may have a considerable impact because some categories (Human rights and CSR strategy) are exclusively based on Boolean indicators. As a consequence, for these categories, a substantial proportion of firms report a score equal to 0.

In Table 2 (Panel B), we report the proportion of firms with a category score equal to 0 for the three pillars and the ten categories at the world level. The distribution of scores is also displayed in Figures 1 to 3. As the table reveals, the problem is particularly acute for the E pillar, because the pick of scores equal to 0 also contaminates the E pillar score itself. Even if there are numeric indicators for these three categories, they also have a large proportion of missing values, so that the score of the categories is often based on Boolean indicators only and therefore may obtain a score equal to 0. This problem is

[8]See https://www.refinitiv.com/en/media-center/press-releases/2020/april/refinitiv-enhances-esg-scoring-methodology-to-reflect-sustainable-industry-developments-and-market-changes.

substantial for Innovation, as 56% of firms worldwide have an Innovation score equal to 0 in 2019. Emission and Resource use scores are also affected by this issue but to a lesser extent, with a proportion of 0 equal to 28% and 29% worldwide in 2019.

Regarding the S categories, we note a substantial fraction of firms with a score equal to 0 for the Human rights and Product responsibility categories. Human rights score is equal to 0 for 42% of firms in 2019. Product responsibility score is equal to 0 for 10% of firms. Finally, as the CSR strategy category is based on Boolean indicators only, it reports approximately 34% of scores equal to 0 in 2019.[9]

2.4 Scores at Category Level

The large frequency of scores equal to 0 for some categories may introduce some distortion in the resulting average score across categories and therefore across pillars. For this reason, we now consider the temporal evolution of scores across categories. Table 3 confirms the large differences in the average score across ESG categories. Categories based on Boolean indicators only (Human rights in the S pillar and CSR strategy in the G pillar) or on a small proportion of numeric indicators with a large proportion of missing values (Innovation in the E pillar) are associated with low average scores. On average, scores are lower for the E pillar than for the S and G pillars.

The table also reveals a substantial heterogeneity across regions. Overall, European firms have higher scores, in particular for E and S categories. Firms in North America and Emerging countries have lower E scores.

On average, scores tend to improve over time. Pacific and Emerging countries benefit from large increases in the ESG score, in particular because of the E and S pillars. In contrast, the ESG score does not improve in North America, mainly because of the decrease in the E pillar.

[Insert Table 3 here]

As reported in Table 4, we find interesting and somehow counter-intuitive results across sectors. The Emission score is much higher for firms in energy, utilities, and basic materials (45%, 47%, and 44%, respectively in 2019), although these industries emit large

[9] Additional results are provided in Technical Appendix B on the proportion of zeros, with a breakdown by regions, industries, and sizes.

quantities of greenhouse gas. In contrast, firms in health care, financial, and technology sectors have very low Emission scores (20%, 30%, and 32%, respectively), although they have low carbon intensity. This difference has two sources: First, a large fraction of energy and utilities companies report on their emission policy, for instance whether they have environmental partnerships, a policy to improve emission reduction, or targets or objectives to be achieved on emission reduction. So large carbon emissions can be at least partly compensated, at the Emission score level, by policy measures taken by the company.[10] In contrast, firms in health care or financials often do not report information on these topics, partly because they consider that they are less concerned by these issues, and therefore obtain low Emission scores, even if they generate low carbon emissions. As a result, the average E score ranges between 17.6 for health care firms and 44.8 for utilities, in 2019. This contrast due to reporting biases is less pronounced for the S and G pillars. The average S score ranges between 42.9 and 46.3 in 2019 across sectors. The average G score is between 40.6 and 53.5.

[Insert Table 4 here]

In Technical Appendix C, we also assess how the size of the firms affects their disclosure policy. We find that large firms (firms in the highest quartile of the market cap) usually tend to disclose more information about their activities, therefore the proportion of numeric indicators with valid values is higher for large firms. Overall, for numeric indicators, this proportion is 31% for the lowest quartile and 45% for the highest quartile. In addition, the proportion of firms with category scores equal to 0 represents approximately 50% of small firms, whereas it represents approximately 10% of large firms. This heterogeneity in the proportion of missing numeric indicators and Boolean indicators equal to 0 is reflected in large differences in pillar and category scores across firms' sizes. For small firms, the average ESG score is close to 30% over the sample. In contrast, for large firms, the average ESG score has increased from 49% in 2010 to 58% in 2019. These results are consistent with the empirical evidence that large firms spent considerable resources for reporting on ESG matters (Drempetic *et al.*, 2020).

[10] This logic is similar to the "best-in-class" approach, in which firms with best practices in their sector can benefit from relatively high industry-adjusted scores.

3 ESG Screening at the Category Level

Our analysis identifies two issues with the implementation of an ESG-based screening investment strategy at the category level. First, the proportion of scores equal to 0 is substantial for 6 out of 10 categories. Setting a low value of the screening threshold (for instance, excluding 1% or 5% of the firms with the lowest scores and reinvesting in the remaining firms proportionately) would result for these categories in the exclusion of some firms that would have a score equal to 0 as other firms that would be kept in the portfolio. Therefore, the screening at the category level is well suited for relatively large screening levels (say, 25% or 33%) as we illustrate below.[11]

Second, given the large heterogeneity of scores across regions or sectors, the screening process will imply significant regional and sectoral biases in the ESG portfolio relative to the market exposures. Such biases would be an issue for investors seeking to hold an otherwise passive portfolio. To address this issue, we proceed as follows. We assume a benchmark portfolio, which reproduces the structure of the targeted market and provides representative weights for the companies. We construct an ESG portfolio based on excluding firms with the lowest scores associated with a given ESG category. In the first strategy, the proceeds of the excluded firms are reinvested proportionately in the remaining firms. As this approach generates large regional and sectoral biases, we consider a second strategy, in which the screening is performed at the region-sector level: The proceeds of the exclusion of low score firms in a given region-sector are reinvested in high score firms in the same region-sector. This strategy is akin to what is often called a "best-in-class" approach, whereby investment managers select the firms with the highest scores within their sector and often also region.

As a large internationally diversified stock market benchmark, we use the MSCI ACWI, which covers developed and emerging markets. For this index, the list of constituents and the corresponding market weights are available, which we use to define the reference weights for regions and sectors. From now on, we consider the subset of firms in the Refinitiv database that also belong to the MSCI ACWI.

As Table 5 reports, the coverage of the MSCI ACWI (and its regional subindexes) with valid scores is particularly high. It is above 95% in developed markets from 2010

[11] An ESG screening based on indicators instead of categories could not be designed because the vast majority of indicators (123 out of 186) are Boolean indicators, which are not suited for a screening approach.

on. For emerging markets, the coverage is above 90% from 2010 on and above 95% from 2017 on.

[Insert Table 5 here]

3.1 Global Screening

The global screening is based on all the firms in the benchmark with scores available at the end of year t. For a screening threshold of θ (say, 25%), we identify all the firms with the lowest scores until their cumulative market cap represents a proportion θ of the market cap of the benchmark portfolio.

For a given score $S_{i,t}$, we denote by $q_{\theta,t}^{(S)}$ the threshold corresponding to probability θ. The list of firms to be excluded is given by $I_{Ex,t} = \{1_{\{S_{i,t} \leq q_{\theta,t}^{(S)}\}}\}_{i=1}^{N_t}$, where N_t is the number of firms available in year t. The threshold $q_{\theta,t}^{(S)}\}$ is defined such that the sum of the market weights of excluded firms, $\sum_{i=1}^{N_t} w_{i,t}^{(b)} \, 1_{\{S_{i,t} \leq q_{\theta,t}^{(S)}\}}$, is as close as possible to the targeted probability, θ, where $w_{i,t}^{(b)}$ is the weight of firm i in the benchmark.

The proceeds of the exclusion are reinvested in the remaining firms, whose list is given by $I_{In,t} = \{1_{\{S_{i,t} > q_{\theta,t}^{(S)}\}}\}_{i=1}^{N_t}$ in proportion of their market weight. The vector of weights in the pure exclusion portfolio p is therefore given by:

$$
\begin{aligned}
w_{i,t}^{(p)} &= 0 \quad \text{for } i \in I_{Ex,t} \quad \text{with} \sum_{i \in I_{Ex,t}} w_{i,t}^{(b)} \approx \theta \\
w_{i,t}^{(p)} &= w_{i,t}^{(b)} \left(\frac{1}{\sum_{i \in I_{Ex,t}} w_{i,t}^{(b)}} \right) \quad \text{for } i \in I_{In,t}.
\end{aligned}
$$

The portfolio composition is consistent with the portfolio of an otherwise passive investor, as the relative weights of the included firms ($I_{In,t}$) will be the same as the benchmark.

Stock market returns of the subsequent year are used to compute the financial performance of the portfolio, so a portfolio built at the end of year t is evaluated at the end of year $t+1$. We consider investors with a preference for some particular dimension of the ESG pillars (for instance for Emission reduction or Human rights). We may also imagine investors interested in combining two or more categories.

Table 6 reports summary statistics for screening portfolios based on the 2010–2019 sample. MSCI ACWI represents the market index, including all firms, even those with no ESG score. The row labeled 'Benchmark' represents the portfolio based on MSCI ACWI

constituents for which Refinitiv ESG scores are available. As the table reveals, for the world index, we lose only 2.4% of the market cap on average due to the lack of Refinitiv scores among firms within the MSCI ACWI.

The first two columns represent the proportion of firms and the proportion of the market value with scores equal to zero, while the next two columns indicate for a given threshold how many firms are actually excluded and which fraction of the market cap is excluded. The comparison of these columns allows us to evaluate the impact of zero scores on the composition of the screening portfolio. First, we note that, as low score firms also tend to have a low market cap, we in fact exclude a rather large fraction of small firms. For the 10% screening criterion (Panel A), we exclude 9.9% of the market cap but 26.2% of the firms with the lowest ESG scores. Similarly, for the 25% screening (Panel B), we exclude 24.7% of the market value but 50.4% of the firms. These proportions are equal to 33% and 60.2%, respectively, for the 33% screening (Panel C).

Second, we turn to categories with a large fraction of firms with a score equal to zero. For the Innovation category, we find that 40.3% of firms in the MSCI index (26.1% of the market cap) have a score equal to zero. Consequently, the lowest screening threshold that we can apply to build a screening portfolio is the 26.1% quantile (to avoid arbitrary selection of firms with a score equal to zero). Similarly, for the Human Rights category, we cannot exclude less than 21.9% of the market cap (40% of the firms). Consequently, for these two categories, the impact of the screening process is much larger than for other scores because it actually corresponds to an approximately 25% screening. For the CSR strategy category, the lower bound for screening is 9.5% of the market cap. These results clearly illustrate the impact of the scoring methodology on the screening strategy. For these categories, because of the large proportion of firms with scores equal to zero, a screening strategy with a low screening threshold cannot be implemented.

[Insert Table 6 here]

The gain on the score (difference between the portfolio score and the benchmark score) is substantial, usually between 4 and 7 points for the 10% threshold. In relative terms (gain divided by benchmark score), the gain is between 6% and 10%. One factor that limits the score gain is that the portfolio is market cap-weighted. As mentioned above, large firms tend to have higher scores than small firms.[12] Therefore, the benchmark

[12]On average, the 25% smallest firms in the ACWI index have an overall ESG score equal to 42.1,

portfolio is already tilted in favor of firms with relatively high scores.

The score gain is the highest for the E category. For the same 10% proportion of excluded firms, the Resource use and Emission scores deliver the highest score gains, above 7 pp. We note, however, that the gain on the E pillar score is much smaller than the gain in the E categories. The reason why the aggregate gain is well below the average of the gain on the categories is that category scores are summed at the firm level first, so that the large proportion of zeros observed for the Innovation score has a limited impact on the distribution of the E pillar score. As category scores are not perfectly correlated across firms, it is more difficult to improve the E pillar score than its components separately. We observe the same result for the other S and G pillar scores and the aggregate ESG score.

Figures 4 to 7 represent the temporal evolution of the E, S, and G score of the screening portfolios based on various levels of screening. These figures demonstrate that, for the Innovation and Human rights categories, the increase in the score relative to the benchmark is very large for the 10% screening threshold because in fact much more than 10% of firms are excluded. For the other categories, the gains relative to the benchmark are similar across categories. The highest and lowest gains are obtained for the Product responsibility score and Workforce score, corresponding to gains equal to 14.2 and 11.5, respectively, for the 25% threshold.

It is important to note that with the 33% screening threshold, methodological issues related to the missing values in numeric and Boolean indicators no longer affect the portfolio construction. The gains in the score relative to the benchmark are substantial for all categories, from 14.1 pp for Workforce to 21.4 pp for Human rights, while the overall ESG score only increases by 11.2 pp.

[Insert Figures 4 to 7 here]

As discussed in the literature review, the performance of ESG portfolios should be adjusted for the ESG risk factor (Pástor *et al.*, 2022). Given the discrepancy between current ESG ratings produced by data providers, properly adjusting for the ESG risk factor is beyond the scope of our paper. For this reason, we use the Sharpe ratio as a measure of risk-adjusted financial performance of the screening portfolios. We focus on the 33% threshold, as the screening strategy can be implemented for all categories.

whereas the 25% largest firms have an overall ESG score equal to 58.6.

Last columns of Table 6 provide statistics on the financial performance of the screening portfolios. The Sharpe ratio remains in the same ballpark as that of the MSCI ACWI. The CSR strategy score generates the lowest Sharpe ratio (0.63 versus 0.69 for the benchmark), while the Community score improves the Sharpe ratio to 0.73. We also report the tracking error relative to the MSCI ACWI. As the table reveals, it is mostly due to the fraction of firms in the index with no ESG scores: On average, the annual tracking error of the benchmark (including all firms of the MSCI ACWI with ESG scores) is equal to 0.9% relative to the MSCI ACWI. Even with the 25% and 33% threshold, the tracking error of the screening portfolios is only increased to 1.4% and 1.5%, respectively.

One reason why the Sharpe ratio of screening portfolios differs from the benchmark Sharpe ratio may be that the screening process implies some changes in the regional and sectoral exposures. Average scores suggest that firms in North America are likely to be underweighted in favor of European firms and that health care firms are likely to be underweighted in favor of financials or utilities for almost all categories. As an illustration of the impact of screening on risk exposures, we consider the screening based on the E score with the 33% threshold. On average over the sample, the screening would imply an overweighting of 6.4 pp (from 23.7% to 28.7%) of European firms and an underweighting of 3.5 pp (from 11% to 7.5%) of firms in Emerging countries. Similarly, the screening would imply an overweighting of 1.9 pp (from 11.7% to 13.6%) of financials and an underweighting of 1.7 pp (from 17.8% to 16.1%) of health care firms.

Such an impact on regional and sectoral exposures would be an issue for investors seeking to improve the ESG quality of their portfolio but without altering their risk exposures. We address this issue in the next section.[13]

3.2 Screening at the Region-Sector Level

We now consider the same screening strategies but while maintaining the same sectoral and regional exposures as in the MSCI ACWI. Therefore, considering the threshold θ, we exclude in each region r and sector s the firms with the lowest scores until their cumulative market cap represents a proportion θ of the market cap of the region r and

[13]It is likely that the ESG portfolios are exposed to other risk factors, such as size or value factors. Maintaining the same exposures to these risk factors as in the benchmark requires an optimization process at each period because the size and value characteristics of firms vary over time, which is not the case of regions and sectors (see Alessandrini and Jondeau, 2021).

sector s in the benchmark portfolio. We denote by R_i and S_i the region and sector of firm i. The set of firms in a given region r and sector s is denoted by $I_t(r,s) = \{1_{\{R_i=r,S_i=s\}}\}_{i=1}^{N_t}$, for any r and s. The list of firms to be excluded in this region-sector is the subset $I_{Ex,t}(r,s) = \{1_{\{R_i=r,S_i=s,S_{i,t}\leq q_{\theta,t}^{(S)}\}}\}_{i=1}^{N_t}$. The list of all the other firms is the subset $I_{I,t}(r,s) = \{1_{\{R_i=r,S_i=s,q_{\theta,t}^{(S)}\leq S_{i,t}\leq q_{1-\theta,t}^{(S)}\}}\}_{i=1}^{N_t}$.

The proceeds are reinvested in the firms with the highest scores in the same region-sector until their cumulative market cap represents a proportion θ of the market cap of the region r and sector s. The set of firms to be overweighted in a region r and sector s is defined as $I_{Ov,t}(r,s) = \{1_{\{R_i=r,S_i=s,S_{i,t}>q_{1-\theta,t}^{(S)}\}}\}_{i=1}^{N_t}$. The vector of weights in given:

$$
\begin{aligned}
w_{i,t}^{(p)} &= 0 \quad \text{for } i \in I_{Ex,t} \quad \text{with} \sum_{i\in I_{Ex,t}} w_{i,t}^{(b)} \approx \theta \\
w_{i,t}^{(p)} &= w_{i,t}^{(b)} \quad \text{for } i \in I_{I,t} \\
w_{i,t}^{(p)} &= w_{i,t}^{(b)} \left(1 + \frac{\sum_{j\in I_{Ex,t}(R_i,S_i)} w_{j,t}^{(b)}}{\sum_{j\in I_{Ov,t}(R_i,S_i)} w_{j,t}^{(b)}}\right) \quad \text{for } i \in I_{Ov,t},
\end{aligned}
$$

with $\sum_{j\in I_{Ov,t}(R_i,S_i)} w_{j,t}^{(b)} \approx \sum_{j\in I_{Ex,t}(R_i,S_i)} w_{j,t}^{(b)}$.

This approach is therefore akin to a best-in-class strategy, in which investors reweigh their portfolio from worst-in-class to best-in-class firms. For this reason, a region-sector approach is more likely to have an impact on the cost of financing of the reweighted firms: The cost of financing of excluded firms would tend to increase, while the cost of financing of overweighted firms would tend to decrease.[14] In Tables 7 and 8, corresponding to the 25% and 33% thresholds, respectively, we consider the cases where the reallocation is performed at the regional level, at the sectoral level, and at the region-sector level.

Starting with the 25% threshold (Table 7), we find that imposing regional exposures (Panel A) results in scores that are slightly lower than those obtained without exposure restrictions. The gain of reallocation is reduced by 0.8 pp (from 12.8 pp to 12 pp). With sectoral reallocation (Panel B), the impact of reallocation on the ESG scores is marginal. Finally, when the reallocation is performed at the region-sector level, the gain in the overall ESG score is equal to 10.3 pp, while it is equal to 14, 11.3, and 11.7 pp for the E, S, and G scores, respectively. For ESG categories, the gain increases on average to 16.7

[14] As pointed out by Pástor *et al.* (2021) and Pástor *et al.* (2022), in equilibrium investors with ESG preferences should expect lower returns, although realized returns may be higher in the short and medium term because of the high demand pressure.

pp, so that gains are approximately 2.5 pp higher than with the global screening. This result suggests that reinvesting in the best-in-class firms at the region-sector level is more effective than reinvesting in all remaining firms proportionately.

For the 33% threshold (Table 8), even with constrained sectoral and regional exposures, reallocation strategies allow investors to benefit from substantial increases in ESG scores.[15] Gains are equal to 16.3, 13.3, and 14 pp for the E, S, and G pillars, respectively. For ESG categories, the gain increases to 19 pp.

Targeting some specific category usually results in larger gains than targeting ESG pillars, for the same reallocation threshold. For instance, in targeting the Emission score, the 33% threshold would allow investors to improve their score from 66.9 to 84.4 in an otherwise passive portfolio. These findings could be particularly relevant for investors who wish to target certain ESG objectives, such as a lower portfolio carbon footprint compared to the benchmark. Without relying on the overall ESG score, these investors could exclude firms with the lowest Emissions scores (thus focusing on the particular underlying ESG category), and achieve similar results as the benchmark in terms of financial performance.

The Sharpe ratios of the reallocation portfolios based on category scores are in the same ballpark as the Sharpe ratio of the benchmark (0.68 vs. 0.69). In addition, the tracking error relative benchmark is lower than 1.4% per year on average, which includes 0.9% due to the constituents of the MSCI ACWI with no ESG score.

[Insert Tables 7 and 8 here]

In Figure 8, we display how the increase in the portfolio score is affected by the reallocation threshold. We vary the reallocation threshold from 5% to 50% and consider the various pillars and categories. The Innovation, Human rights, Product responsibility, and CSR strategy categories achieve substantial increases in the category scores, even with a modest reallocation threshold, because all firms with zero scores are excluded simultaneously, resulting in the larger than expected reallocation. For other categories, the score gain increases steadily, up to 20 pp for the 50% threshold.

Figure 9 reports the Sharpe ratio of the various portfolios, as well as the Sharpe ratio of the MSCI ACWI (horizontal line). The negative impact of the reallocation is marginal

[15] We note that, for the 33% threshold, the proportion of the market capitalization excluded is often slightly larger than 67%. The reason is that we reallocate firms at the region-sector level. So for each region-sector, we reallocate at most 33% of the market capitalization. As we do not have perfectly granularity in market cap, we often reduce slightly less than 33% of the market cap, which results in the discrepancy we observe in the table.

for the E categories and moderate for the S categories (for thresholds up to 40%). For the G pillar, only for the Sharpe ratio of the CSR strategy category decreases significantly.

Finally, Figure 10 indicates that the annual tracking error usually increases as the reallocation is more severe. However, it remains below 1.8%, even for reallocation thresholds as high as 50%, while the tracking error of the portfolio with no reallocation (but with only firms with an ESG score) is equal to 0.9%. Consequently, a reallocation strategy based on a rather high threshold (such as the 33% threshold) can be implemented at a relatively low financial cost.

It is worth noting that constraining regional and sectoral exposures not only results in lower gains on the ESG score, but also allows investors to hold a portfolio that is otherwise passive, as it is not exposed to regional and sectoral risk relative to the market portfolio. This result suggests that investing in a portfolio with a higher ESG category score, with minimal regional and sectoral risk exposures relative to the market portfolio can be attained at almost no cost in terms of financial performance.

[Insert Figures 8 to 10 here]

4 Conclusion

While ESG investing has gained in popularity in the last decades, many institutional investors struggle with the inherent limitations of ESG scores. These limitations include the lack of transparency about the methodologies, the wide divergence between ESG ratings, and potential conflicts of interest in the ESG rating business (Kotsantonis and Serafeim, 2019, Berg *et al.*, 2019, IOSCO, 2021). Moreover, devising investment strategies based on an amalgamation of three fundamentally different topics underpinning ESG investing has also been a practical hurdle, especially given the potential for weak scores in one pillar to be offset by strong scores in another pillar. We use the Refinitiv ESG database, which allows us to deconstruct ESG scores and analyze indicators in depth. On this basis, we address two important questions regarding ESG investment in equity markets. First, we investigate the characteristics of the various categories of ESG factors and find that they do not all contain the same quality of underlying information – and hence may not have the same desired positive impact from an investment perspective. Specifically, several category scores are essentially based on Boolean indicators. Given

the methodological choice of Refinitiv to assign a negative score when the firms fail to disclose information, these categories suffer from a high proportion of scores equal to 0, which makes it difficult to differentiate between firms. As a consequence, an investment strategy based on excluding firms with low category scores may not be implementable. For other categories, implementing an exclusion strategy is credible and allows investors to substantially improve the score of their portfolio after exclusion.

Second, regarding the financial characteristics of the screening portfolios, we find that they do not suffer from a lower risk-adjusted performance compared to a wide stock market benchmark. However, the screening process also results in significant regional and sectoral biases relative to this benchmark. Such biases may be undesirable for investors seeking to hold an otherwise passive portfolio. We demonstrate that a best-in-class approach imposing the same regional and sectoral exposures as the benchmark slightly increases the gain on the targeted score with no material impact on the risk-adjusted performance and minimal increase in the tracking error of the portfolio.

In addition, shifting focus from aggregate ESG pillar scores and ratings to more granular characteristics (to the extent they may be available from the various ESG data vendors) has three key non-financial advantages relative to the use of ESG scores. First, a focus on specific categories would enable investors to overcome the "aggregate confusion" created by consolidated ESG scores or ratings and directly focus on factors that are most relevant to their investment mandates. For example, an investor seeking to protect the environment and universal human values could target themes such as emission reduction or human rights. Second, focusing on specific themes would help them better track the sustainability performance trajectory of their investments vis-à-vis their stated sustainable investment objectives. This would also help initiate divestments or reweigh investments within the portfolio when there is a notable development. Finally, over time, the focus on themes would also enable investors to develop their own ESG assessment models using actual and observed third-party vendor data, thereby overcoming vendor-specific concerns.

References

Alessandrini, F. and Jondeau, E. (2021). Optimal strategies for ESG portfolios. *Journal of Portfolio Management*, **47**(6), 114–138.

Amel-Zadeh, A. and Serafeim, G. (2021). Why and how investors use ESG information: Evidence from a global survey. *Financial Analysts Journal*, **74**(3), 87–103.

Berg, F., Koelbel, J., and Rigobon, R. (2019). Aggregate confusion: The divergence of ESG ratings. MIT Sloan School, Working Paper No. 5822-19.

Berg, F., Fabisik, K., and Sautner, Z. (2020). Rewriting history II: The (un)predictable past of ESG ratings. ECGI Finance Working Paper No. 708/2020.

Billio, M., Costola, M., Histova, I., Latino, C., and Pelizzon, L. (2021). Inside the ESG ratings: (dis)agreement and performance. *Corporate Social Responsibility and Environmental Management*, **28**(5), 1426–1445.

Bloomberg (2021). ESG assets rising to $50 trillion will reshape $140.5 trillion of global AUM by 2025, finds Bloomberg Intelligence. Bloomberg, 21 July. Available at https://www.bloomberg.com/company/press/esg-assets-rising-to-50-trillion-will-reshape-140-5-trillion-of-global-aum-by-2025-finds-bloomberg-intelligence/.

Bonnefon, J.-F., Landier, A., Sastry, P. R., and Thesmar, D. (2022). The moral preferences of investors: Experimental evidence. NBER Working Paper No. 29647.

Demers, E., Hendrikse, J., Joos, P., and Lev, B. (2021). ESG did not immunize stocks during the COVID-19 crisis, but investments in intangible assets did. *Journal of Business Finance and Accounting*, **48(3–4)**, 433–462.

Drempetic, S., Klein, C., and Zwergel, B. (2020). The influence of firm size on the ESG score: Corporate sustainability ratings under review. *Journal of Business Ethics*, **167**, 333–360.

Elmalt, D., Igan, D., and Kirti, D. (2021). Limits to private climate change mitigation. IMF Working Paper No. 21/112.

Fabozzi, F. J., Ma, K. C., and Oliphant, B. J. (2008). Sin stock returns. *Journal of Portfolio Management*, **35**(1), 82–94.

Friede, G., Busch, T., and Bassen, A. (2015). ESG and financial performance: Aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance and Investment*, **5**(4), 210–233.

Garel, A. and Petit-Romec, A. (2021). Investors rewards to environmental responsibility: Evidence from the COVID-19 crisis. *Journal of Corporate Finance*, **68**, 101948.

Gibson, R., Krueger, P., Riand, N., and Schmidt, P. S. (2021). ESG rating disagreement and stock returns. *Financial Analyst Journal*, **77(4)**, 104–127.

GSIA, Global Sustainable Investment Alliance (2020). Global sustainable investment review. Biennial Report.

Hong, H. and Kacperczyk, M. (2009). The price of sin: The effects of social norms on markets. *Journal of Financial Economics*, **93**(1), 15–36.

IFC, International Finance Corporation (2021). *Investing for Impact: The Global Impact Investing Market 2020*. World Bank.

IMF, International Monetary Fund (2021). Global financial stability report. IMF report, COVID-19, Crypto, and Climate: Navigating Challenging Transitions.

IOSCO, International Organization of Securities Commissions (2021). Environmental, Social and Governance (ESG) ratings and data products providers. The Board of the International Organization of Securities Commissions, Final Report.

Kotsantonis, S. and Serafeim, G. (2019). Four things no one will tell you about ESG data. *Journal of Applied Corporate Finance*, **31**(2), 50–58.

Lins, K. V., Servaes, H., and Tamayo, A. (2017). Social capital, trust, and firm performance: The value of corporate social responsibility during the financial crisis. *Journal of Finance*, **72**(4), 1785–1824.

Pástor, L., Stambaugh, R. F., and Taylor, L. A. (2021). Sustainable investing in equilibrium. *Journal of Financial Economics*, **142(2)**, 550–571.

Pástor, L., Stambaugh, R. F., and Taylor, L. A. (2022). Dissecting green returns. *Journal of Financial Economics*, **146(2)**, 403–424.

Pedersen, L. H., Fitzgibbons, S., and Pomorski, L. (2021). Responsible investing: The ESG-efficient frontier. *Journal of Financial Economics*, **142(2)**, 572–597.

Refinitiv (2021). Environmental, Social, and Governance (ESG) scores from Refinitiv. Technical report.

Sahin, O., Bax, K., Paterlini, S., and Czado, C. (2021). ESGM: ESG scores and the Missing pillar. Available at SSRN: https://ssrn.com/abstract=3890696.

Scatigna, M., Xia, D., Zabai, A., and Zulaica, O. (2021). Achievements and challenges in ESG markets. BIS Quarterly Review, December 2021.

Serafeim, G. and Yoon, A. (2021). Stock price reactions to ESG news: The role of ESG ratings and disagreement. Forthcoming in Review of Accounting Studies.

Table 1. Global Coverage of Refinitiv Database

Year	Firms with valid market cap		Firms with valid ESG score		Firms with valid market cap		Firms with valid ESG score	
	Number	(%)	Number	(%)	Number	(%)	Number	(%)
	World				**North America**			
2010	7590	74.8	3911	51.5	2762	69.6	1264	45.8
2011	7739	76.3	4017	51.9	2818	71.0	1250	44.4
2012	7979	78.7	4096	51.3	2914	73.4	1232	42.3
2013	8236	81.2	4212	51.1	3053	76.9	1246	40.8
2014	8640	85.2	4342	50.3	3231	81.4	1256	38.9
2015	8959	88.3	5231	58.4	3383	85.2	1908	56.4
2016	9118	89.9	6110	67.0	3451	86.9	2622	76.0
2017	9381	92.5	6696	71.4	3576	90.1	2797	78.2
2018	9761	96.2	7433	76.1	3780	95.2	2875	76.1
2019	9944	98.0	8182	82.3	3884	97.9	3249	83.7
	Europe				**Pacific**			
2010	1538	76.6	918	59.7	1159	82.8	832	71.8
2011	1552	77.3	929	59.9	1184	84.6	851	71.9
2012	1586	79.0	930	58.6	1196	85.5	863	72.2
2013	1627	81.1	937	57.6	1218	87.1	923	75.8
2014	1715	85.5	957	55.8	1277	91.3	958	75.0
2015	1792	89.3	1059	59.1	1306	93.4	995	76.2
2016	1822	90.8	1072	58.8	1339	95.7	1029	76.8
2017	1876	93.5	1152	61.4	1357	97.0	1053	77.6
2018	1941	96.7	1599	82.4	1370	97.9	1068	78.0
2019	1972	98.3	1630	82.7	1380	98.6	1117	80.9
	Emerging countries							
2010	1807	79.1	840	46.5				
2011	1846	80.8	924	50.1				
2012	1926	84.3	1004	52.1				
2013	1967	86.1	1040	52.9				
2014	2008	87.9	1105	55.0				
2015	2056	90.0	1158	56.3				
2016	2076	90.9	1253	60.4				
2017	2130	93.2	1542	72.4				
2018	2212	96.8	1718	77.7				
2019	2246	98.3	2003	89.2				

Note: This table reports the global coverage of the Refinitiv database: it reports the number of firms with a valid market capitalization and its proportion relative to the total number of firms listed in the database in the given region (as of 2020); it also reports the number of firms with a valid ESG score and its proportion relative to the total number of firms with a valid market capitalization in the given region. The sample covers the period from 2010 to 2019.

Table 2. Proportion of Valid Values and Zero Values

Category	Nb of numeric items	2010	2015	2019
Panel A: Proportion of valid values in numeric indicators				
ESG	63	37.2	39.1	39.7
Environment	27	18.9	19.6	20.8
Emission reduction	14	21.8	22.4	21.3
Innovation	7	12.1	11.1	16.1
Resource use	6	20.3	23.2	24.8
Social	19	24.1	29.2	30.5
Community	1	39.3	37.0	35.2
Human rights	0	–	–	–
Product responsibility	2	4.9	13.1	12.9
Workforce	16	25.5	30.7	32.4
Governance	17	80.9	81.2	80.1
CSR strategy	0	–	–	–
Management	14	80.8	80.0	78.6
Shareholders	3	81.4	86.9	87.3
Panel B: Proportion of scores with zero value				
ESG	63	0.0	0.0	0.0
Environment	27	17.9	21.0	21.2
Emission reduction	14	26.6	29.8	28.2
Innovation	7	56.1	56.6	56.5
Resource use	6	27.6	29.1	29.4
Social	19	0.0	0.0	0.0
Community	1	0.6	0.0	0.0
Human rights	0	66.6	55.4	41.9
Product responsibility	2	24.8	17.2	10.0
Workforce	16	0.0	0.0	0.0
Governance	17	0.0	0.0	0.0
CSR strategy	0	35.1	36.4	33.9
Management	14	0.0	0.0	0.0
Shareholders	3	0.0	0.0	0.0

Note: This table reports the proportion of valid values in numeric indicators and the proportion of scores with zero values in the Refinitiv database. The sample covers the period from 2010 to 2019.

Table 3. Average Scores by Region

Category	2010	2015	2019	2010	2015	2019	2010	2015	2019
	World			**North America**			**Europe**		
ESG	40.4	41.4	42.8	38.9	37.5	37.1	49.9	51.9	52.5
Environment	32.8	31.9	32.1	26.9	23.3	20.5	48.5	47.9	46.3
Emission Score	36.7	35.2	36.1	29.5	24.5	22.3	54.8	54.1	52.5
Innovation	21.9	21.7	21.8	18.1	15.7	13.7	32.0	32.5	32.3
Resource use	36.3	35.5	35.5	29.5	26.4	23.0	54.8	53.7	51.5
Social	39.3	42.0	44.8	40.7	39.5	39.9	50.3	55.3	57.7
Community	49.9	50.0	50.2	64.8	59.3	56.7	50.3	53.1	51.3
Human rights	16.7	22.3	29.3	12.4	16.5	19.4	31.9	41.1	51.9
Product resp.	37.6	41.4	45.0	37.1	37.1	38.8	46.2	52.5	55.7
Workforce	50.3	50.1	50.4	46.1	40.4	37.6	68.1	68.9	67.8
Governance	47.9	47.6	47.9	47.1	46.3	45.9	49.4	49.5	50.1
CSR Strategy	32.6	31.8	33.3	27.3	21.4	19.4	42.3	43.8	45.7
Management	50.3	50.1	50.1	50.1	50.2	49.9	50.5	50.3	50.8
Shareholders	50.2	50.1	50.1	50.2	50.1	50.0	50.4	50.3	50.6
	Pacific			**Emerging countries**					
ESG	36.1	38.4	45.0	36.6	41.4	43.3			
Environment	35.5	31.5	39.7	27.0	33.0	35.8			
Emission	31.3	34.4	44.4	31.2	37.2	41.0			
Innovation	34.4	23.7	28.0	16.2	21.3	23.7			
Resource use	23.4	33.7	42.3	30.5	36.8	39.6			
Social	33.3	35.3	44.4	34.5	40.8	43.0			
Community	30.5	37.7	43.1	40.3	43.4	43.2			
Human rights	36.7	13.4	26.3	13.3	23.5	28.7			
Product resp.	10.5	39.8	48.7	33.9	41.1	44.9			
Workforce	33.5	47.7	56.8	48.1	52.3	54.0			
Governance	39.4	47.6	48.8	47.5	48.2	48.9			
CSR Strategy	47.2	33.2	40.4	32.6	37.5	42.1			
Management	30.2	49.8	50.3	49.7	49.8	50.0			
Shareholders	50.0	49.7	49.3	50.1	49.9	50.0			

Note: This table reports the average scores for each region in the Refinitiv database. The sample covers the period from 2010 to 2019.

Table 4. Average Scores by Sector

Category	2010	2015	2019	2010	2015	2019	2010	2015	2019
	Energy			**Basic Materials**			**Industrials**		
ESG	36.7	38.9	42.8	39.1	42.7	45.1	41.0	41.9	44.2
Environment	31.1	32.5	37.0	37.4	39.5	41.4	36.5	35.8	37.3
Emission	38.6	40.0	45.3	40.1	43.1	44.5	40.3	37.8	41.4
Innovation	11.7	12.5	15.8	19.5	21.5	25.4	26.6	27.8	27.9
Resource use	35.1	37.0	40.6	40.3	42.3	43.5	39.1	39.4	40.9
Social	35.7	37.9	42.9	36.3	40.0	44.3	38.9	42.2	45.0
Community	50.0	50.2	50.7	49.6	50.2	51.2	49.2	50.1	50.1
Human rights	14.8	19.6	30.4	19.6	27.2	36.1	18.0	26.9	35.4
Product resp.	32.7	38.5	43.0	34.2	39.4	43.2	42.1	43.7	45.8
Workforce	50.3	50.2	50.8	50.2	50.2	51.0	50.0	50.1	50.1
Governance	47.7	49.2	50.9	46.8	52.0	52.1	48.1	47.3	49.9
CSR strategy	35.0	36.3	41.6	41.3	44.5	49.6	34.2	33.2	36.5
Management	49.4	51.2	51.8	46.9	52.4	52.1	49.6	49.4	52.2
Shareholders	50.6	51.4	54.2	50.1	55.5	53.6	52.5	49.5	51.0
	Consumer Cyclical			**Consumer Non Cycl.**			**Financials**		
ESG Score	39.2	41.0	43.8	42.8	43.3	45.1	41.4	41.6	42.3
Environment	31.9	32.7	34.5	38.9	38.0	40.4	24.6	23.4	23.9
Emission	34.1	35.1	37.8	40.6	39.8	43.3	32.5	29.2	30.1
Innovation	20.6	21.0	22.3	27.9	25.2	26.0	20.3	19.9	21.1
Resource use	36.4	36.1	38.1	41.0	40.5	42.9	29.8	28.2	27.6
Social	39.0	41.5	45.4	40.8	43.1	45.3	40.8	42.4	44.4
Community	49.8	49.9	50.2	49.8	50.0	50.6	50.1	50.1	49.8
Human rights	20.1	25.0	33.9	22.0	29.0	35.0	10.9	14.1	21.4
Product resp.	36.1	40.6	46.1	44.7	45.7	46.6	35.0	39.8	45.0
Workforce	50.0	50.0	50.5	50.0	50.0	51.0	50.2	50.2	50.2
Governance	43.9	45.4	47.9	50.9	49.2	49.6	49.3	47.8	47.2
CSR strategy	26.4	28.5	31.5	39.1	39.3	43.5	27.3	26.3	27.9
Management	47.4	48.3	50.9	53.4	50.6	50.2	52.8	51.7	50.7
Shareholders	43.8	47.2	48.5	50.4	51.2	51.6	52.2	48.9	48.2
	Health Care			**Technology**			**Utilities**		
ESG	39.6	38.5	36.3	42.3	42.2	42.3	44.1	44.3	47.5
Environment	26.2	22.2	17.6	34.0	30.4	28.2	40.4	41.5	44.8
Emission	29.6	24.5	20.3	35.8	33.0	32.5	47.3	46.2	47.2
Innovation	9.9	6.1	4.8	30.2	25.3	20.7	29.2	34.8	41.4
Resource use	30.8	27.2	20.5	37.0	34.7	34.1	43.3	42.5	45.4
Social	39.9	42.2	43.3	40.6	44.0	45.0	41.8	42.8	46.3
Community	50.4	50.0	49.8	49.9	50.0	49.9	49.9	50.0	50.0
Human rights	15.4	18.7	17.7	18.9	27.3	30.9	18.9	21.6	35.9
Product resp.	41.1	43.6	45.6	42.8	44.9	45.3	41.5	42.9	44.0
Workforce	50.4	50.1	49.9	50.4	50.1	50.1	50.0	50.0	50.4
Governance	47.3	44.4	40.6	50.3	47.3	46.8	54.1	50.8	53.5
CSR strategy	25.7	21.0	16.5	30.4	28.5	27.7	50.8	46.7	55.0
Management	51.4	47.2	43.4	53.2	50.5	49.5	56.4	52.5	54.7
Shareholders	47.7	50.6	47.2	53.7	49.3	50.1	48.6	47.9	48.6

Note: This table reports the average scores for each sector in the Refinitiv database. The sample covers the period from 2010 to 2019.

Table 5. Coverage of MSCI Constituents with Refinitiv Database

Year	Number of firms in benchmark	Propor. with market cap (in %)	Propor. with valid score (in %)	Number of firms in benchmark	Propor. with market cap (in %)	Propor. with valid score (in %)
	Panel A: World			**Panel B: North America**		
2010	2462	92.6	96.2	691.0	92.8	96.4
2011	2435	93.8	96.4	690.0	93.0	96.6
2012	2431	93.7	96.4	701.0	93.0	96.4
2013	2434	94.7	97.1	706.0	94.1	97.2
2014	2470	95.1	97.6	726.0	94.4	97.7
2015	2491	95.4	97.9	727.0	96.0	98.2
2016	2486	95.9	98.1	724.0	97.1	98.6
2017	2499	96.6	98.7	725.0	97.5	99.3
2018	2758	96.9	98.9	713.0	98.2	99.5
2019	3051	93.4	99.0	728.0	94.1	99.6
	Panel C: Europe			**Panel D: Pacific**		
2010	544	92.8	96.6	489.0	95.9	98.5
2011	529	93.4	96.6	462.0	97.0	98.7
2012	514	93.0	96.3	463.0	96.8	98.9
2013	517	95.4	96.9	463.0	97.8	99.1
2014	527	95.8	97.3	461.0	97.8	99.2
2015	530	96.0	97.2	468.0	98.3	99.3
2016	531	96.0	97.4	469.0	98.5	99.5
2017	532	97.2	98.0	471.0	99.2	99.5
2018	512	97.1	98.4	470.0	98.7	99.7
2019	507	94.9	98.4	469.0	97.2	99.9
	Panel E: Emerging countries					
2010	802	89.2	91.2			
2011	820	92.0	92.3			
2012	821	91.7	92.8			
2013	824	92.2	93.3			
2014	834	92.9	94.7			
2015	838	92.1	94.2			
2016	832	92.8	94.0			
2017	846	93.7	95.4			
2018	1125	94.8	95.5			
2019	1404	90.5	95.5			

Note: This table reports the global coverage of the Refinitiv database: it reports the number of firms with a valid market capitalization and its proportion relative to the total number of firms in the database in the given region (as of 2020); it also reports the number of firms with a valid ESG score and its proportion relative to the total number of firms with a valid market capitalization in the given region. The sample covers the period from 2010 to 2019.

Table 6. Summary Statistics on Exclusion Portfolio – Global Exclusion / Reinvestment

Category	Prop. firms zeros	Prop. mkt cap zeros	Prop. firms exclud.	Prop. mkt cap exclud.	Bench-mark score	Port-folio score	Score gain	Ann. return	Ann. vola-tility	Sharpe ratio	Ann. track. error
MSCI ACWI	–	–	0.0	0.0	–	–	–	9.71	14.07	0.69	–
Benchmark	–	–	5.2	2.4	–	–	–	9.91	14.34	0.69	0.94
Panel A: 10% **threshold**											
ESG	0.0	0.0	26.2	9.9	64.0	68.4	4.4	9.85	14.41	0.68	1.16
Environment	8.9	4.1	22.6	9.8	61.2	67.3	6.1	9.64	14.37	0.67	1.08
Emission	13.6	6.2	21.8	9.9	66.9	73.9	7.0	9.57	14.37	0.67	1.11
Innovation	40.3	26.1	40.3	26.1	44.1	59.8	15.7	10.05	14.30	0.70	1.53
Resource Use	13.9	6.0	23.7	9.9	69.2	76.4	7.2	9.74	14.36	0.68	1.06
Social	0.0	0.0	27.1	9.9	65.4	70.2	4.8	10.02	14.38	0.70	1.13
Community	0.6	0.2	27.7	9.9	73.4	79.6	6.2	10.19	14.48	0.70	1.20
Human Rights	39.8	21.9	40.2	22.1	50.3	64.5	14.2	9.67	14.46	0.67	1.29
Product Resp.	13.0	4.5	20.4	10.0	61.0	67.0	5.9	10.03	14.25	0.70	1.05
Workforce	0.0	0.0	23.3	9.8	72.8	78.4	5.7	9.84	14.41	0.68	1.07
Governance	0.0	0.0	20.0	9.9	63.7	68.3	4.7	9.67	14.35	0.67	1.16
CSR Strategy	18.7	9.5	20.2	10.3	61.9	69.0	7.1	9.60	14.37	0.67	1.09
Management	0.0	0.0	18.2	9.9	65.9	71.7	5.8	9.84	14.34	0.69	1.13
Shareholders	0.0	0.0	13.0	9.8	57.4	62.9	5.5	9.79	14.38	0.68	1.14
Panel B: 25% **threshold**											
ESG	0.0	0.0	50.4	24.7	64.0	73.0	9.1	9.81	14.33	0.68	1.40
Environment	8.9	4.1	47.2	24.7	61.2	74.3	13.1	9.58	14.31	0.67	1.37
Emission	13.6	6.2	46.4	24.7	66.9	81.3	14.4	9.60	14.37	0.67	1.33
Innovation	40.3	26.1	40.5	26.3	44.1	60.0	15.9	10.06	14.32	0.70	1.55
Resource Use	13.9	6.0	49.2	24.8	69.2	83.9	14.7	9.79	14.40	0.68	1.33
Social	0.0	0.0	49.6	24.7	65.4	75.5	10.1	10.12	14.37	0.70	1.37
Community	0.6	0.2	49.7	24.8	73.4	85.8	12.4	10.60	14.48	0.73	1.45
Human Rights	39.8	21.9	47.6	26.5	50.3	67.3	17.0	9.69	14.52	0.67	1.44
Product Resp.	13.0	4.5	37.7	25.3	61.0	75.2	14.2	9.64	14.15	0.68	1.34
Workforce	0.0	0.0	43.7	24.5	72.8	84.2	11.5	9.54	14.48	0.66	1.36
Governance	0.0	0.0	40.6	24.7	63.7	73.8	10.1	9.95	14.38	0.69	1.33
CSR Strategy	18.7	9.5	44.4	26.1	61.9	78.3	16.5	9.19	14.42	0.64	1.46
Management	0.0	0.0	38.1	24.7	65.9	78.7	12.7	10.10	14.39	0.70	1.22
Shareholders	0.0	0.0	30.8	24.7	57.4	70.4	13.0	9.78	14.35	0.68	1.23
Panel C: 33% **threshold**											
ESG	0.0	0.0	60.2	33.0	64.0	75.2	11.2	9.70	14.29	0.68	1.60
Environment	8.9	4.1	55.7	32.6	61.2	77.1	15.9	8.99	14.16	0.64	1.62
Emission	13.6	6.2	55.2	32.9	66.9	84.4	17.5	9.33	14.51	0.64	1.59
Innovation	40.3	26.1	49.5	33.5	44.1	64.8	20.7	10.12	14.36	0.70	1.56
Resource Use	13.9	6.0	59.1	32.9	69.2	86.9	17.7	9.64	14.42	0.67	1.50
Social	0.0	0.0	58.4	32.9	65.4	78.1	12.7	9.62	14.42	0.67	1.64
Community	0.6	0.2	57.4	32.8	73.4	88.4	15.0	10.53	14.45	0.73	1.62
Human Rights	39.8	21.9	55.0	33.1	50.3	71.7	21.4	9.76	14.44	0.68	1.51
Product Resp.	13.0	4.5	48.2	33.1	61.0	79.2	18.2	9.56	14.12	0.68	1.39
Workforce	0.0	0.0	53.1	32.9	72.8	86.8	14.1	9.45	14.51	0.65	1.49
Governance	0.0	0.0	49.6	32.9	63.7	76.4	12.7	9.97	14.40	0.69	1.41
CSR Strategy	18.7	9.5	52.8	33.4	61.9	81.6	19.7	8.99	14.36	0.63	1.68
Management	0.0	0.0	46.7	32.8	65.9	82.0	16.1	10.35	14.42	0.72	1.37
Shareholders	0.0	0.0	40.0	33.0	57.4	74.4	17.0	9.95	14.32	0.69	1.34

Note: This table reports summary statistics for exclusion portfolios based on 10%, 25%, and 33% thresholds. The first two columns report the proportion of firms and the fraction of the market value with zero scores. The next two columns report the proportion of excluded firms and excluded market value relative to the MSCI ACWI. The sample includes firms that belong to the MSCI ACWI with an ESG score over the period from 2010 to 2019. Financial performance measures are computed from 2011 to 2020.

Table 7. Summary Statistics on Exclusion Portfolio – 25% exclusion

Category	Prop. firms excluded	Prop. mkt cap excluded	Bench-mark score	Port-folio score	Score gain	Ann. return	Ann. vola-tility	Sharpe ratio	Ann. track. error
MSCI ACWI	0.0	0.0	–	–	–	9.71	14.07	0.69	–
Benchmark	5.2	2.4	–	–	–	9.91	14.34	0.69	0.94
Panel A: Regional exclusion and reinvestment									
ESG	45.0	24.4	64.0	72.2	8.2	9.72	14.25	0.68	1.47
Environment	41.6	24.4	61.2	73.0	11.8	9.45	14.21	0.67	1.53
Emission	41.1	24.3	66.9	79.9	13.0	9.64	14.30	0.67	1.32
Innovation	41.7	28.0	44.1	60.7	16.7	10.04	14.30	0.70	1.91
Resource Use	43.2	24.4	69.2	82.4	13.2	9.75	14.20	0.69	1.24
Social	44.0	24.4	65.4	74.5	9.1	10.01	14.20	0.71	1.39
Community	39.1	24.5	73.4	83.7	10.3	9.78	14.45	0.68	1.50
Human Rights	47.5	28.5	50.3	67.2	16.9	9.79	14.30	0.68	1.48
Product Resp.	37.6	25.4	61.0	74.7	13.7	9.78	14.05	0.70	1.34
Workforce	40.9	24.3	72.8	83.2	10.4	9.60	14.38	0.67	1.40
Governance	37.0	24.3	63.7	73.3	9.7	9.79	14.32	0.68	1.46
CSR Strategy	41.5	25.7	61.9	77.2	15.3	9.12	14.28	0.64	1.61
Management	35.3	24.3	65.9	78.2	12.2	10.12	14.30	0.71	1.33
Shareholders	28.4	24.4	57.4	70.0	12.7	9.72	14.40	0.67	1.41
Panel B: Sectoral exclusion and reinvestment									
ESG	49.2	24.3	64.0	72.7	8.7	9.88	14.33	0.69	1.71
Environment	46.7	24.0	61.2	73.5	12.3	9.73	14.29	0.68	1.69
Emission	45.8	24.1	66.9	80.6	13.7	9.70	14.35	0.68	1.54
Innovation	45.9	30.7	44.1	62.6	18.5	10.06	14.40	0.70	1.70
Resource Use	47.9	24.4	69.2	83.3	14.1	9.83	14.40	0.68	1.56
Social	48.3	24.1	65.4	75.1	9.7	9.97	14.40	0.69	1.63
Community	47.5	25.3	73.4	85.4	11.9	10.53	14.44	0.73	1.54
Human Rights	50.0	29.1	50.3	68.7	18.4	9.54	14.51	0.66	1.96
Product Resp.	41.8	29.6	61.0	77.0	16.0	9.55	14.25	0.67	1.54
Workforce	42.7	24.0	72.8	83.7	11.0	9.77	14.36	0.68	1.63
Governance	39.1	24.0	63.7	73.2	9.5	10.00	14.34	0.70	1.38
CSR Strategy	44.4	25.5	61.9	77.3	15.4	9.51	14.42	0.66	1.50
Management	36.6	24.2	65.9	78.1	12.2	10.09	14.37	0.70	1.30
Shareholders	30.2	24.0	57.4	69.9	12.5	9.85	14.28	0.69	1.30
Panel C: Sector-region exclusion and reinvestment									
ESG	42.0	23.3	64.0	74.2	10.3	9.56	14.34	0.67	1.50
Environment	40.4	22.8	61.2	75.2	14.0	9.42	14.26	0.66	1.43
Emission	39.7	22.5	66.9	81.9	15.0	9.67	14.29	0.68	1.25
Innovation	45.4	31.2	44.1	66.7	22.6	10.03	14.47	0.69	1.49
Resource Use	41.5	23.1	69.2	84.2	15.0	9.61	14.19	0.68	1.23
Social	41.1	22.7	65.4	76.7	11.3	9.54	14.33	0.67	1.47
Community	37.4	23.3	73.4	85.4	11.9	9.90	14.43	0.69	1.34
Human Rights	48.8	31.0	50.3	73.3	23.0	9.87	14.43	0.68	1.56
Product Resp.	40.3	30.0	61.0	80.6	19.5	9.86	14.29	0.69	1.48
Workforce	38.5	22.4	72.8	84.6	11.9	9.60	14.30	0.67	1.35
Governance	34.5	22.4	63.7	75.3	11.7	9.82	14.40	0.68	1.28
CSR Strategy	40.9	24.9	61.9	79.8	18.0	9.34	14.28	0.65	1.42
Management	32.9	22.5	65.9	80.5	14.6	10.02	14.37	0.70	1.23
Shareholders	28.1	22.1	57.4	72.9	15.6	9.99	14.38	0.69	1.25

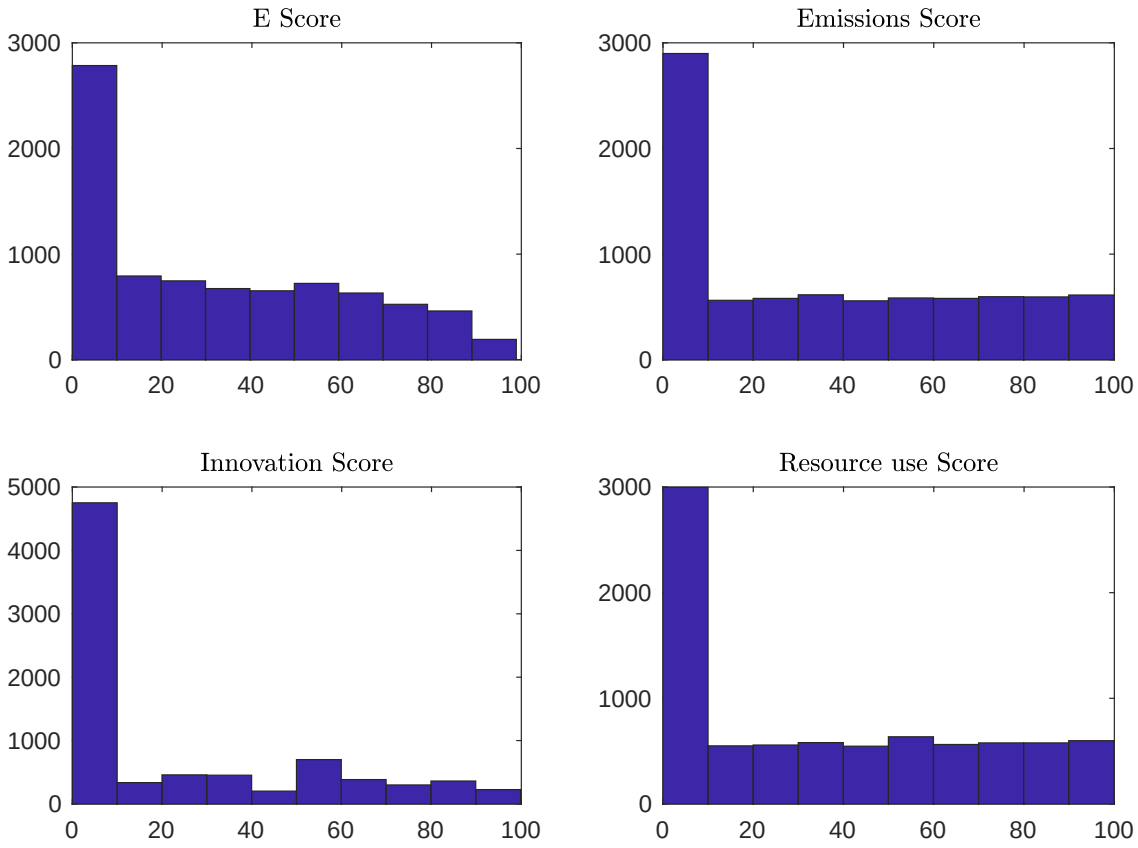
Note: This table reports summary statistics for portfolios based on sectoral, regional, and region-sector exclusion at the 25% threshold. The first two columns report the proportion of excluded firms and of the excluded market value relative to the MSCI ACWI. The sample includes firms that belong to the MSCI ACWI with an ESG score over the period from 2010 to 2019. Financial performance measures are computed from 2011 to 2020.

Table 8. Summary Statistics on Exclusion Portfolio – 33% exclusion

Category	Prop. firms excluded	Prop. mkt cap excluded	Bench-mark score	Port-folio score	Score gain	Ann. return	Ann. vola-tility	Sharpe ratio	Ann. track. error
MSCI ACWI	0.0	0.0	–	–	–	9.71	14.07	0.69	–
Benchmark	5.2	2.4	–	–	–	9.91	14.34	0.69	0.94
Panel A: Regional exclusion and reinvestment									
ESG	54.5	32.4	64.0	74.1	10.2	9.51	14.19	0.67	1.72
Environment	51.0	31.9	61.2	75.4	14.2	9.20	14.12	0.65	1.70
Emission	50.2	32.4	66.9	82.7	15.7	9.46	14.24	0.66	1.45
Innovation	46.9	33.7	44.1	64.2	20.1	9.89	14.45	0.68	1.94
Resource Use	53.2	32.4	69.2	85.0	15.8	9.74	14.13	0.69	1.30
Social	53.4	32.4	65.4	76.7	11.3	9.59	14.18	0.68	1.59
Community	48.3	32.4	73.4	86.2	12.8	9.62	14.46	0.67	1.54
Human Rights	52.3	34.0	50.3	69.5	19.2	9.90	14.16	0.70	1.49
Product Resp.	47.4	33.1	61.0	78.2	17.2	9.99	13.99	0.71	1.35
Workforce	50.1	32.5	72.8	85.5	12.8	9.76	14.33	0.68	1.35
Governance	46.9	32.4	63.7	75.8	12.1	9.80	14.29	0.69	1.57
CSR Strategy	50.0	33.5	61.9	80.5	18.6	8.90	14.22	0.63	1.84
Management	44.8	32.5	65.9	81.4	15.5	10.18	14.33	0.71	1.49
Shareholders	37.2	32.5	57.4	73.7	16.4	9.71	14.41	0.67	1.36
Panel B: Sectoral exclusion and reinvestment									
ESG	58.7	32.3	64.0	74.7	10.8	9.72	14.37	0.68	1.83
Environment	55.7	31.9	61.2	76.4	15.2	9.64	14.34	0.67	1.77
Emission	54.7	32.1	66.9	83.6	16.7	9.63	14.39	0.67	1.76
Innovation	53.5	37.4	44.1	66.0	21.9	9.80	14.40	0.68	1.80
Resource Use	56.9	32.4	69.2	86.2	16.9	9.58	14.46	0.66	1.72
Social	56.7	31.9	65.4	77.5	12.1	9.84	14.45	0.68	1.77
Community	55.9	32.7	73.4	87.8	14.4	10.62	14.52	0.73	1.70
Human Rights	55.8	34.6	50.3	71.7	21.4	9.62	14.60	0.66	2.00
Product Resp.	49.7	36.0	61.0	79.9	18.8	9.52	14.17	0.67	1.59
Workforce	51.3	32.3	72.8	86.3	13.5	9.58	14.35	0.67	1.68
Governance	47.9	32.3	63.7	75.7	12.0	10.09	14.36	0.70	1.50
CSR Strategy	53.2	33.6	61.9	80.5	18.7	9.36	14.46	0.65	1.67
Management	45.4	32.2	65.9	81.3	15.4	10.19	14.40	0.71	1.44
Shareholders	39.4	32.4	57.4	73.8	16.4	10.12	14.31	0.71	1.35
Panel C: Sector-region exclusion and reinvestment									
ESG	51.6	31.0	64.0	75.8	11.9	9.50	14.30	0.66	1.54
Environment	49.2	30.4	61.2	77.5	16.3	9.24	14.26	0.65	1.49
Emission	48.2	30.6	66.9	84.4	17.5	9.77	14.13	0.69	1.34
Innovation	50.8	37.4	44.1	68.5	24.4	9.74	14.41	0.68	1.56
Resource Use	50.0	30.9	69.2	86.5	17.3	9.42	14.11	0.67	1.39
Social	49.8	30.7	65.4	78.7	13.3	9.54	14.32	0.67	1.49
Community	45.7	31.4	73.4	87.6	14.2	9.71	14.43	0.67	1.39
Human Rights	53.5	36.2	50.3	74.3	24.0	9.77	14.45	0.68	1.60
Product Resp.	48.2	36.2	61.0	82.3	21.3	9.54	14.18	0.67	1.47
Workforce	47.6	30.9	72.8	87.0	14.2	9.65	14.23	0.68	1.34
Governance	43.5	30.7	63.7	77.6	14.0	9.99	14.36	0.70	1.40
CSR Strategy	49.5	33.0	61.9	82.5	20.6	8.91	14.29	0.62	1.60
Management	41.5	30.5	65.9	83.4	17.5	10.14	14.43	0.70	1.34
Shareholders	36.3	30.7	57.4	76.6	19.2	10.25	14.50	0.71	1.41

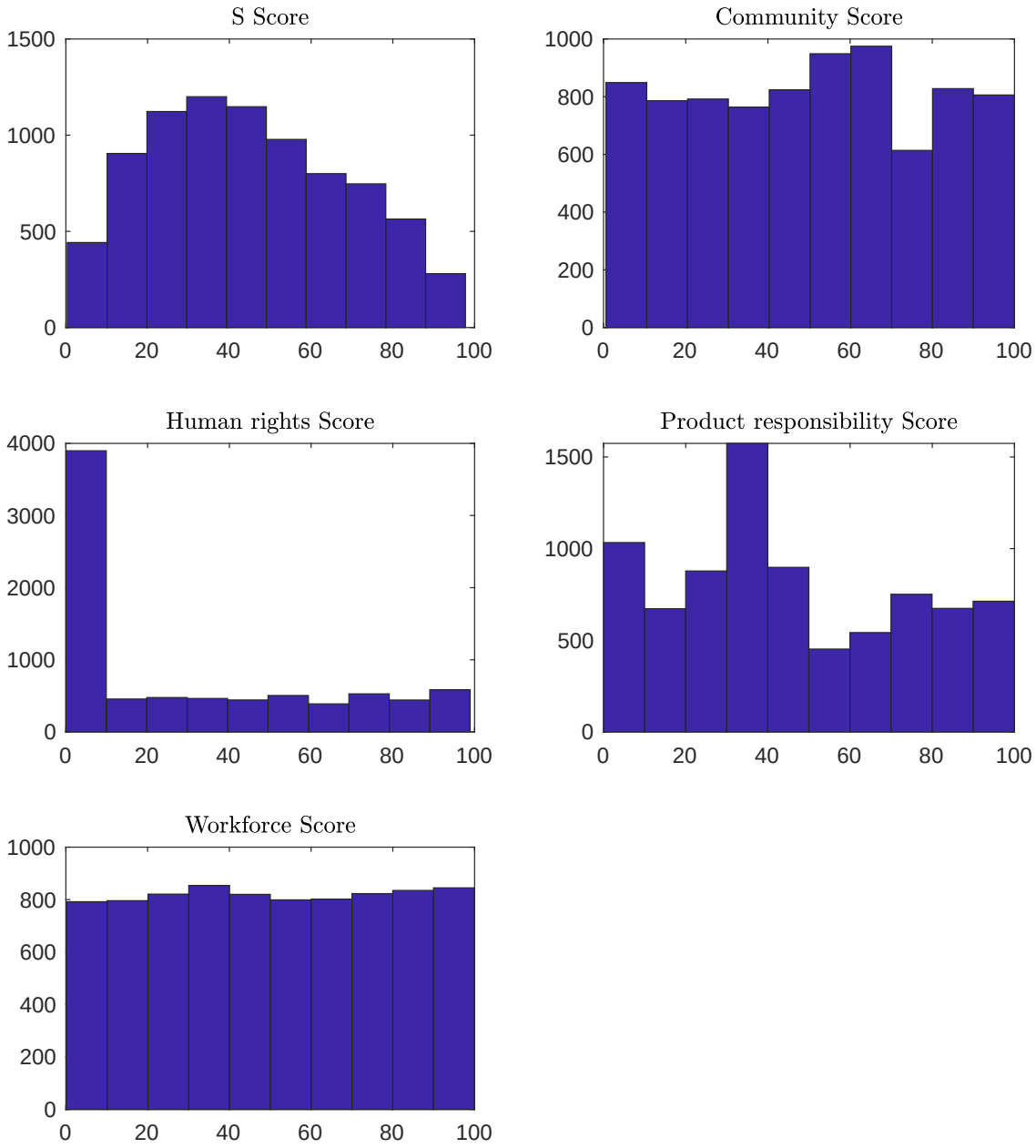
Note: This table reports summary statistics for portfolios based on sectoral, regional, and region-sector exclusion at the 33% threshold. The first two columns report the proportion of excluded firms and of the excluded market value relative to the MSCI ACWI. The sample includes firms that belong to the MSCI ACWI with an ESG score over the period from 2010 to 2019. Financial performance measures are computed from 2011 to 2020.

Figure 1. Distribution of the E Score and Categories – 2019



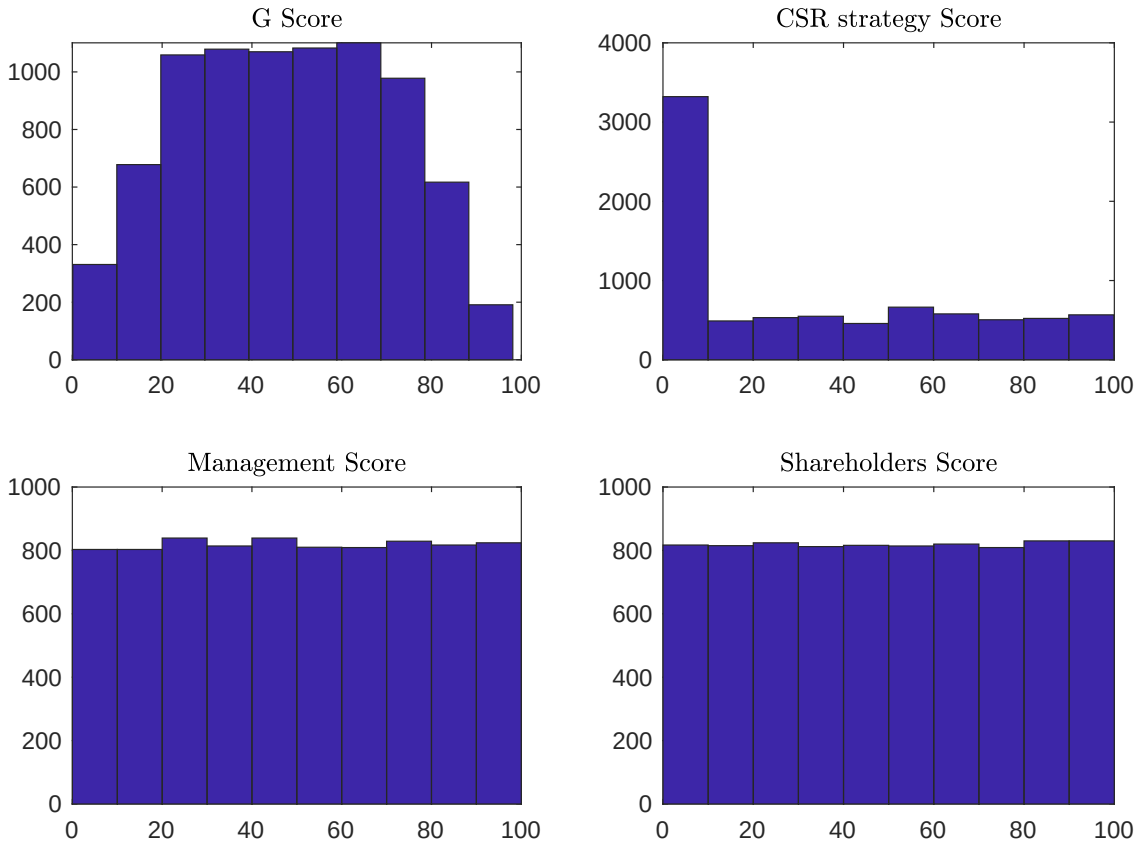
Note: This figure displays the cross-section distribution of scores for the E pillar and its categories for 2019.

Figure 2. Distribution of the S Score and Categories – 2019



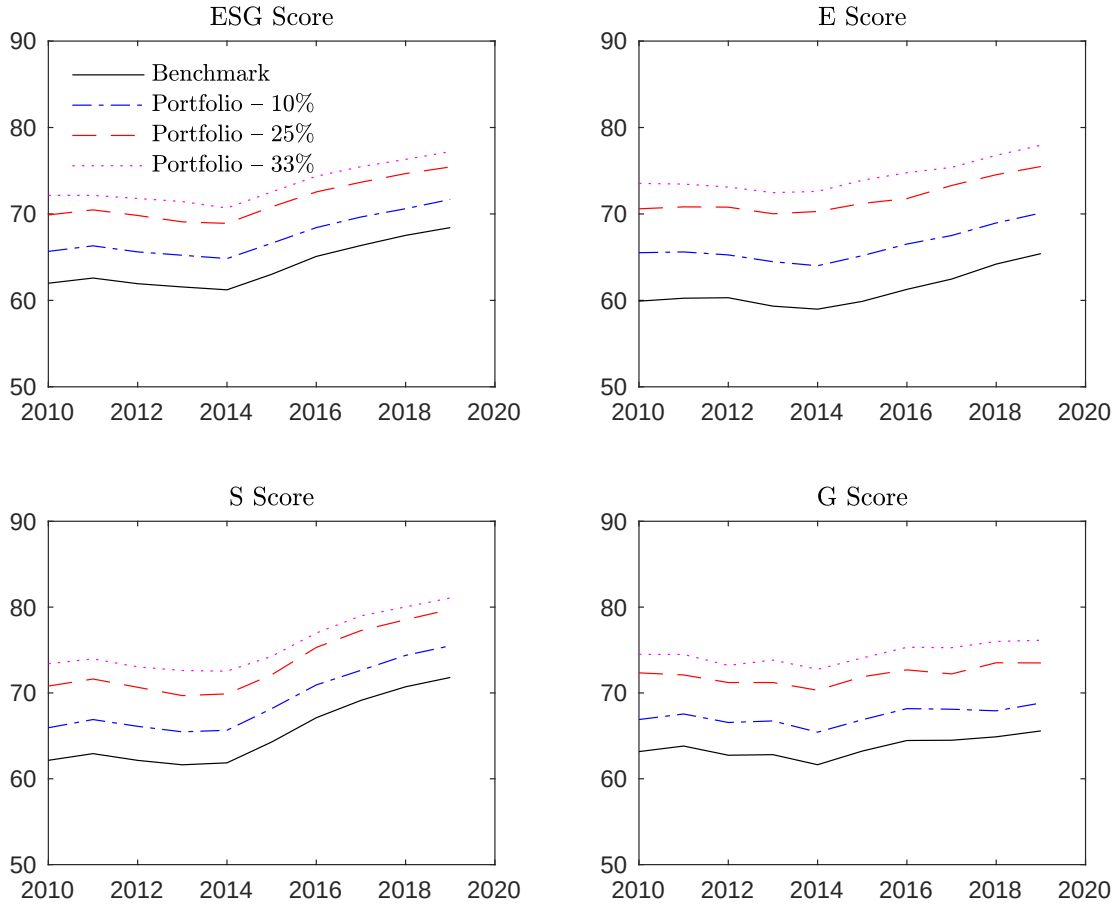
Note: This figure displays the cross-section distribution of scores for the S pillar and its categories for 2019.

Figure 3. Distribution of the G Score and Categories – 2019



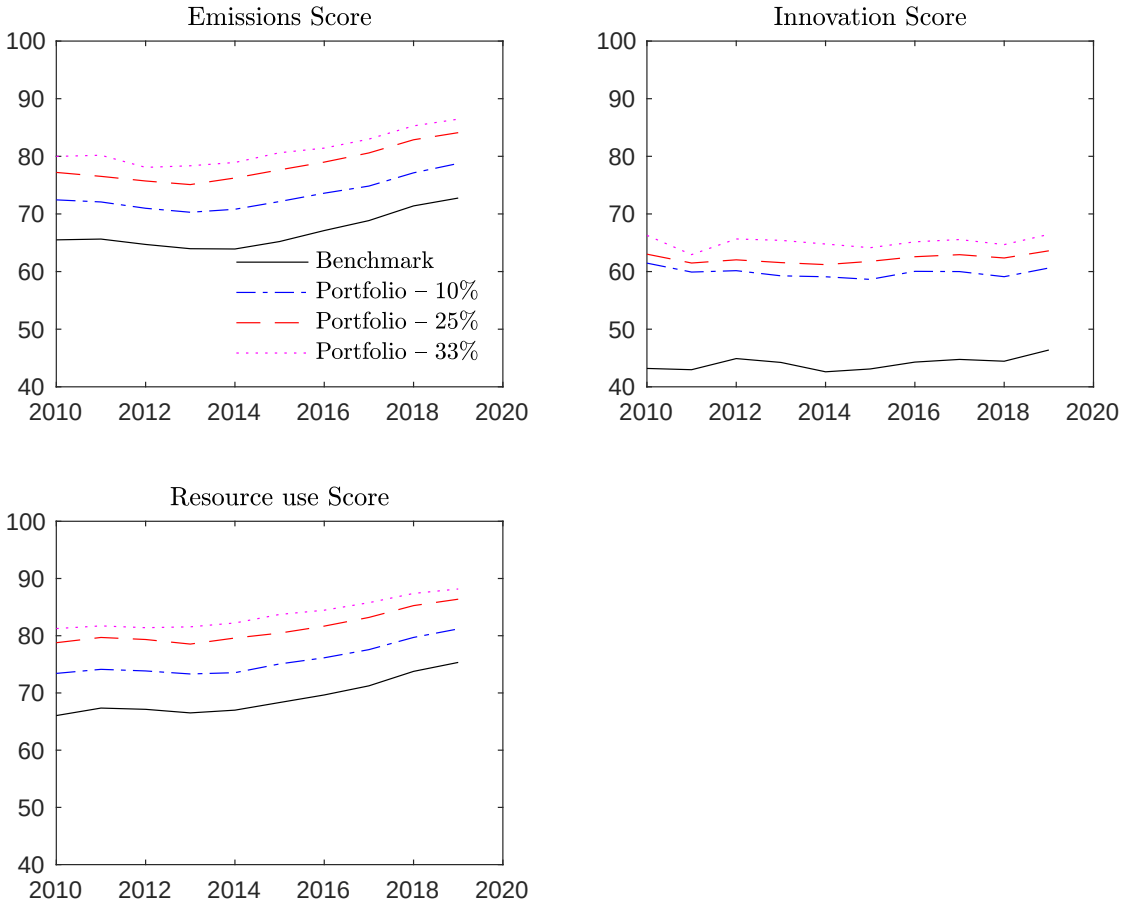
Note: This figure displays the cross-section distribution of scores for the G pillar and its categories for 2019.

Figure 4. Scores of Exclusion Portfolio – ESG Pillars



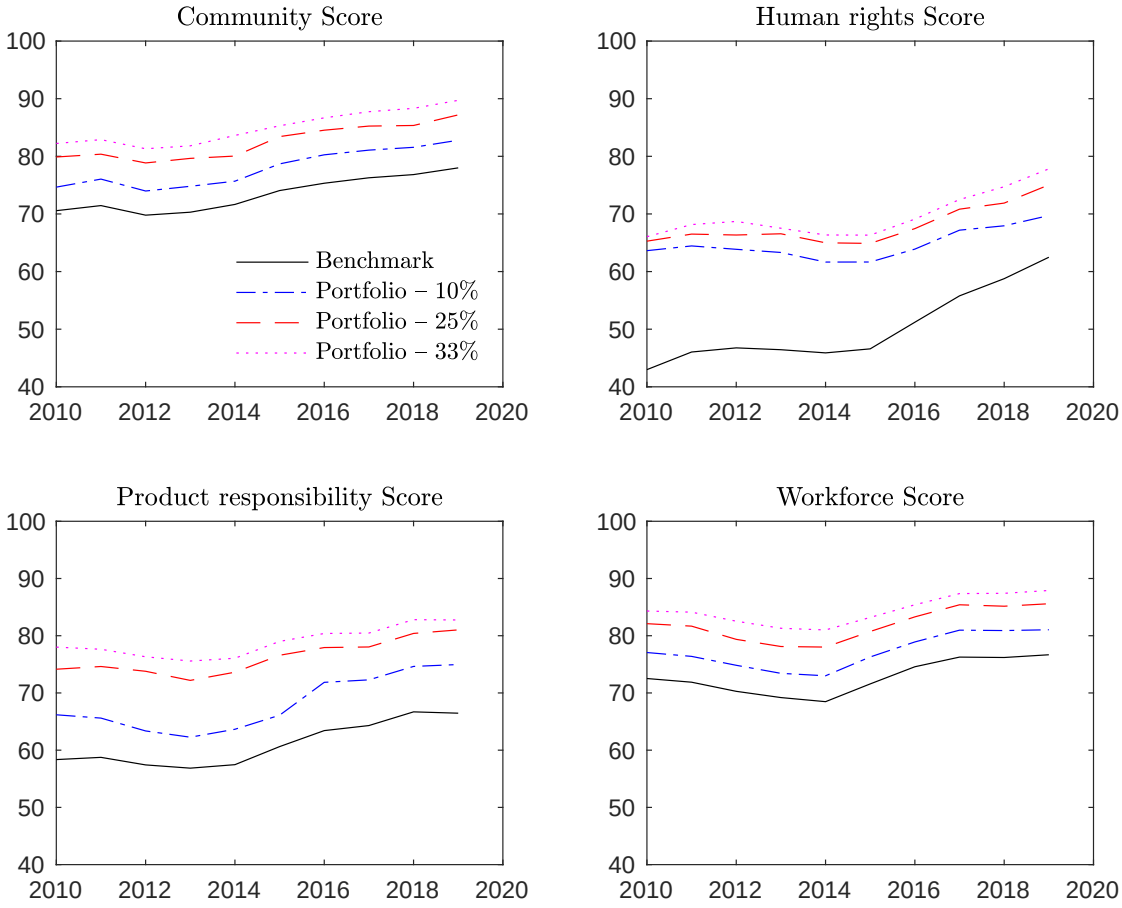
Note: This figure displays the temporal evolution of the score of the benchmark and the exclusion portfolios based on the 10%, 25%, and 33% thresholds, for the ESG, E, S, and G pillars.

Figure 5. Scores of Exclusion Portfolio – E Categories



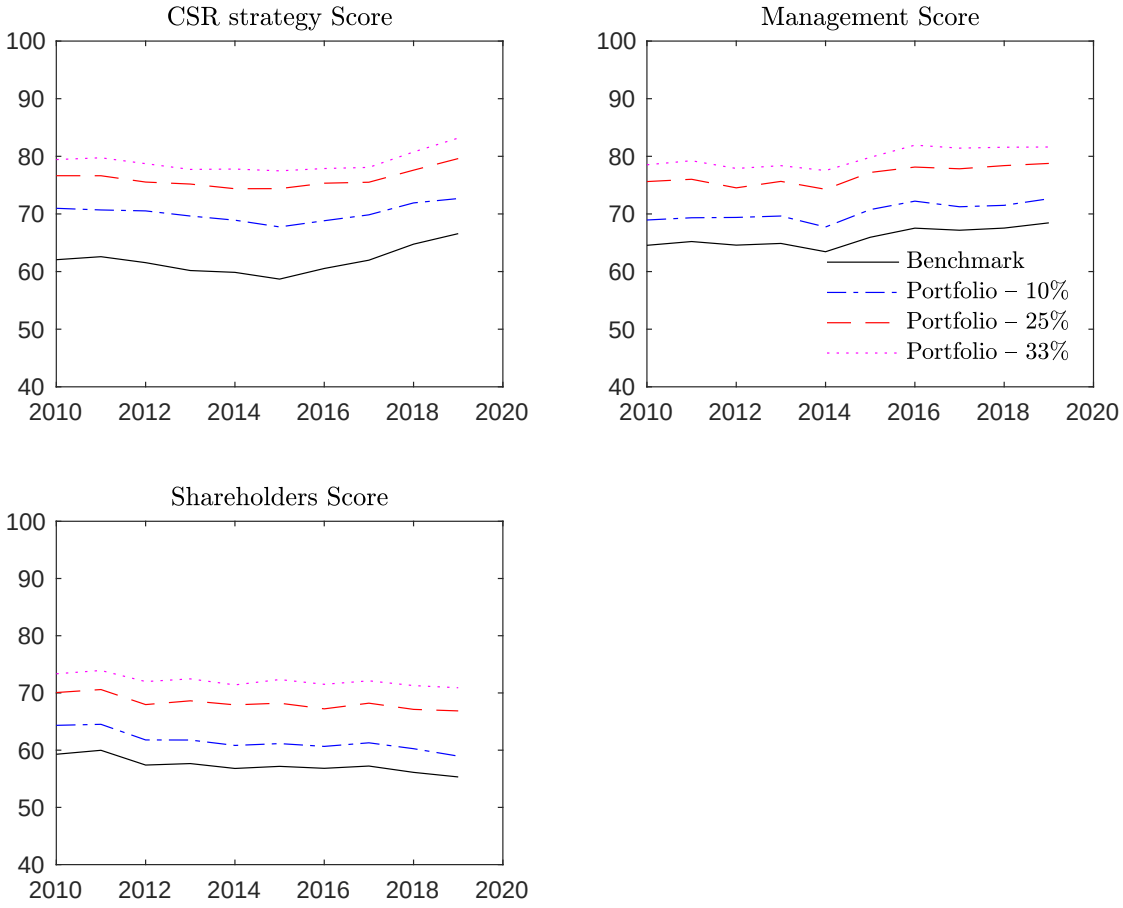
Note: This figure displays the temporal evolution of the score of the benchmark and the exclusion portfolios based on the 10%, 25%, and 33% thresholds, for the E pillar and its categories.

Figure 6. Scores of Exclusion Portfolio – S Categories



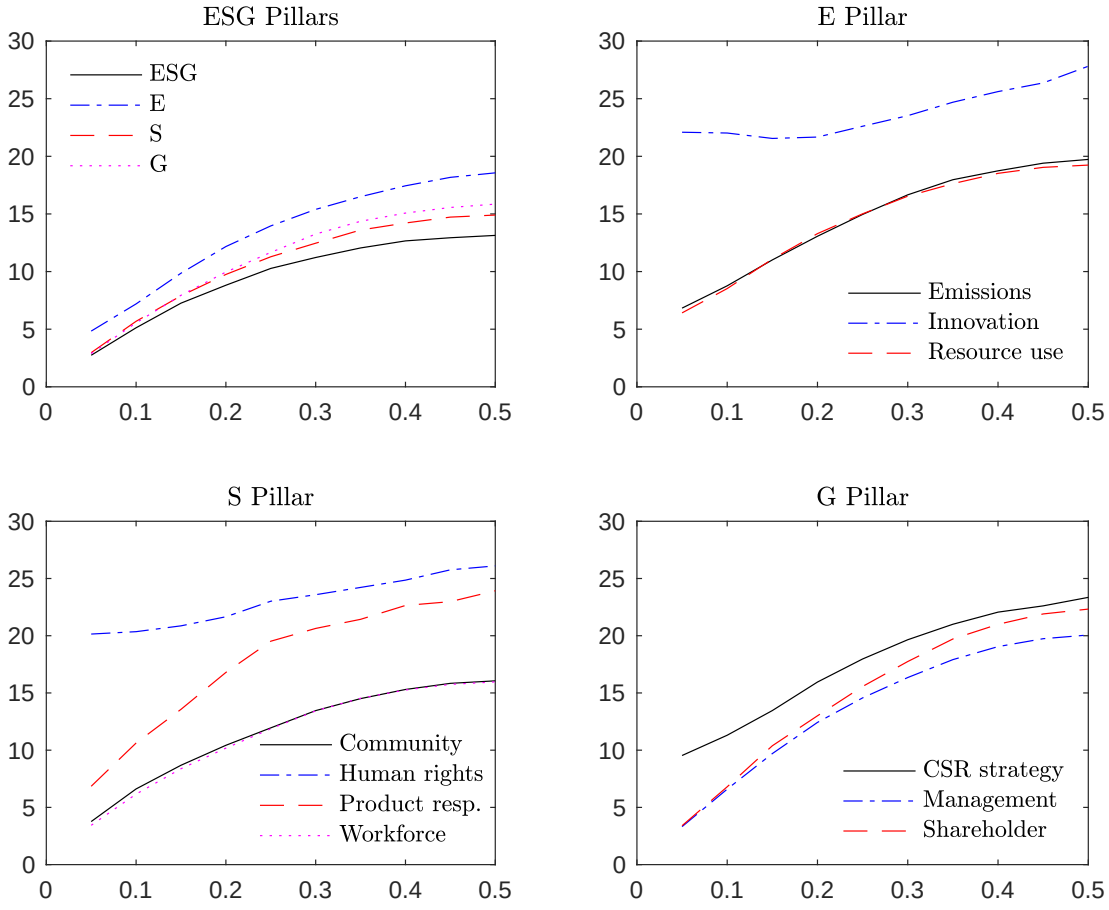
Note: This figure displays the temporal evolution of the score of the benchmark and the exclusion portfolios based on the 10%, 25%, and 33% thresholds, for the S pillar and its categories.

Figure 7. Scores of Exclusion Portfolio – G Categories



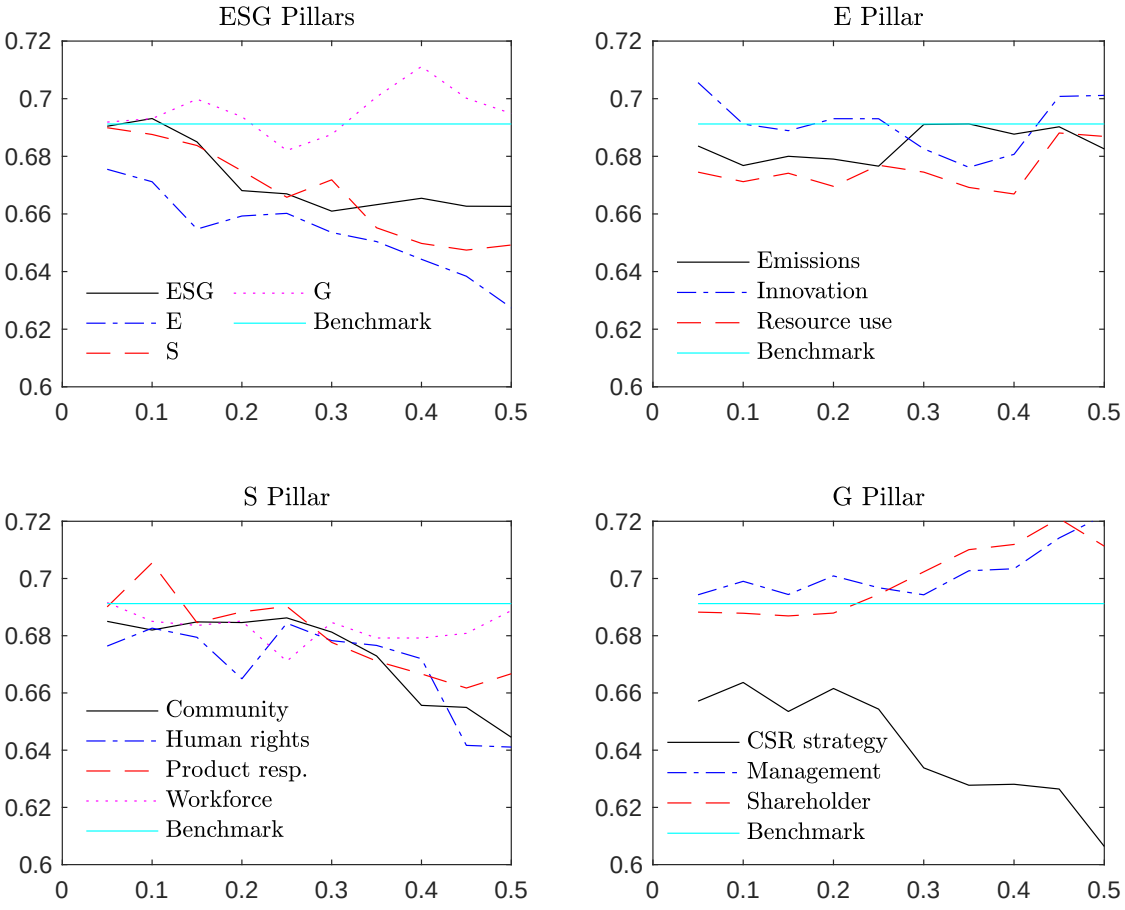
Note: This figure displays the temporal evolution of the score of the benchmark and the exclusion portfolios based on the 10%, 25%, and 33% thresholds, for the G pillar and its categories.

Figure 8. Impact of Exclusion Threshold on the Score Gain



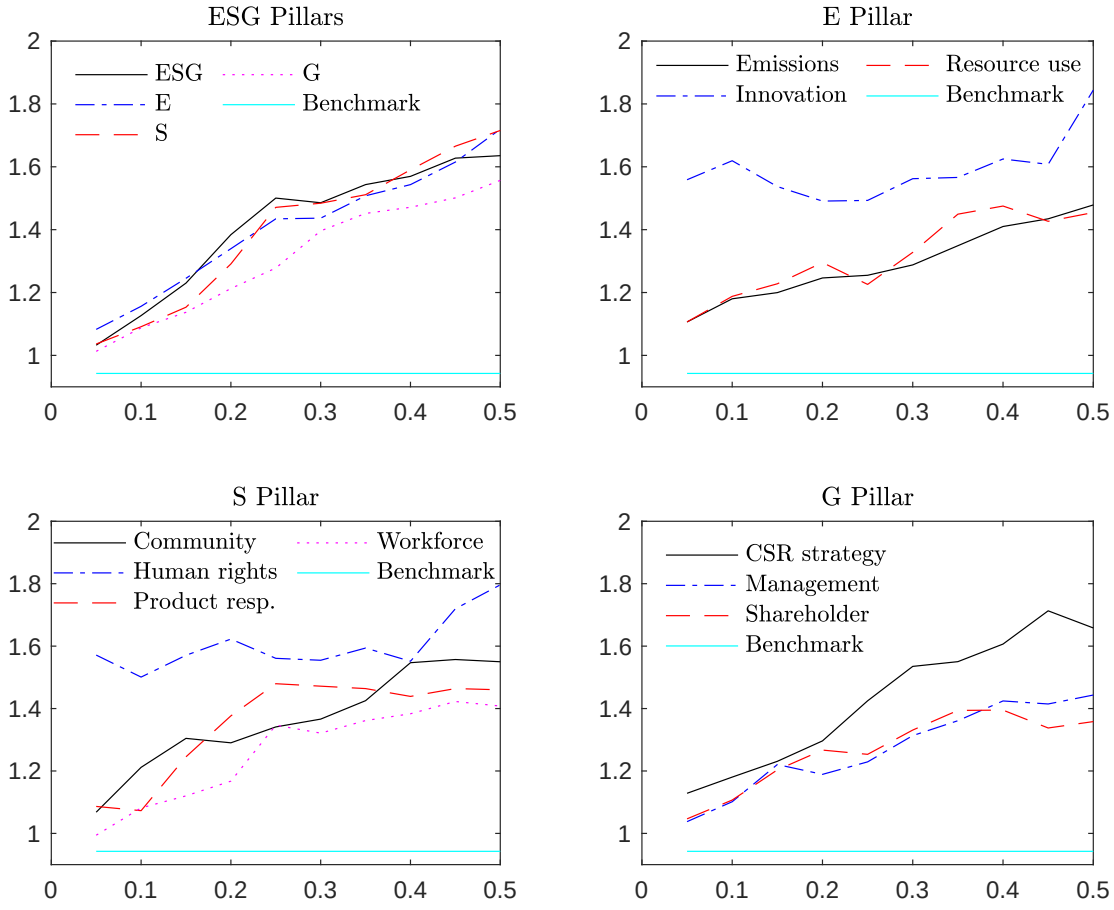
Note: This figure displays the gain in the score of the exclusion portfolios when the threshold is increased from 5% to 50%, for the various pillars and categories.

Figure 9. Impact of Exclusion Threshold on the Sharpe Ratio



Note: This figure displays the Sharpe ratio of the exclusion portfolios when the threshold is increased from 5% to 50%, for the various pillars and categories.

Figure 10. Impact of Exclusion Threshold on the Tracking Error



Note: This figure displays the annual tracking error of the exclusion portfolios when the threshold is increased from 5% to 50%, for the various pillars and categories.

Technical Appendix

A Additional Results on Missing Values

In Table A.1, we consider results for the different regions. The proportion of valid values is on average higher for Europe than for other regions. The average proportion is 48% for Europe but 35% for North America and Pacific and 38% for Emerging countries. The difference is larger for the E and S pillars: 32% and 38% for the indicators in the E and S pillars in Europe versus 10% and 21% in North America. Numeric indicators in the E pillar have a proportion of valid values close to 20% on average in Pacific and Emerging countries.

In Table A.2, we report the proportion of valid values across the main industries. We do not report results for the real estate sector because the number of firms is insufficient. Results are, broadly speaking, similar across industries, although there are some notable differences. In particular, the disclosure of information related to the E pillar is rather different across industries: Financials have a low record of numeric indicators (below 8% on average), while firms in basic materials and utilities have the highest reporting standards (23% and 20%, respectively). Importantly, firms in sectors with the highest carbon intensity (energy, utilities, and basic materials) disclose relatively more than other sectors for the numeric indicators in the Emission reduction category (close to 20% on average). We also observe the same pattern for the Resource use category. One possible explanation for firms in energy-related sectors to disclose more information about environmental issues is that these issues are very material for their investors. For the S pillar, financials have the lowest level of disclosure for the aggregate pillar and for the three categories (except Human rights). Disclosure is particularly low for the Product responsibility and Workforce categories. In contrast, firms in the consumer non cyclical sector report a high level of disclosure on the S pillar. Regarding the G pillar, almost 90% of the firms report on the indicators related to governance on average at the end of the sample. We do not observe any significant difference across sectors.

Table A.1. Proportion of Valid Values in Numeric Indicators by Region

Category	Nb of numeric items	2010	2015	2019	2010	2015	2019	2010	2015	2019
		World			**North America**			**Europe**		
ESG	63	37.2	39.1	39.7	35.1	34.8	34.7	47.1	49.3	48.4
Environment	27	18.9	19.6	20.8	13.3	12.7	13.8	33.2	34.0	32.6
Emission	14	21.8	22.4	21.3	13.9	12.8	11.7	37.4	38.0	32.9
Innovation	7	12.1	11.1	16.1	13.6	11.9	19.7	24.6	24.7	26.9
Resource use	6	20.3	23.2	24.8	11.5	13.2	13.5	31.9	33.9	37.4
Social	19	24.1	29.2	30.5	21.4	23.1	22.0	32.8	40.0	41.1
Community	1	39.3	37.0	35.2	27.9	22.1	17.4	55.0	45.9	34.4
Human rights	0	–	–	–	–	–	–	–	–	–
Product resp.	2	4.9	13.1	12.9	2.5	5.9	5.0	8.9	21.4	19.9
Workforce	16	25.5	30.7	32.4	23.3	25.3	24.4	34.5	42.0	44.1
Governance	17	80.9	81.2	80.1	87.9	85.7	85.0	86.9	85.9	83.7
CSR strategy	0	–	–	–	–	–	–	–	–	–
Management	14	80.8	80.0	78.6	87.1	83.9	82.9	85.9	84.7	82.0
Shareholders	3	81.4	86.9	87.3	91.7	94.2	94.9	91.9	91.8	91.7
		Pacific			**Emerging countries**					
ESG	63	32.3	35.9	39.8	33.9	38.8	39.4			
Environment	27	19.0	19.8	25.4	16.6	22.1	23.7			
Emission	14	20.1	20.5	24.7	18.8	24.7	23.9			
Innovation	7	16.7	16.2	23.7	6.0	7.4	17.3			
Resource use	6	18.3	21.3	28.6	20.3	28.5	28.5			
Social	19	16.4	25.0	29.5	25.9	32.9	35.7			
Community	1	23.1	30.9	36.5	55.3	59.6	64.8			
Human rights	0	–	–	–	–	–	–			
Product resp.	2	1.3	11.7	13.5	7.5	17.7	17.5			
Workforce	16	17.9	26.3	31.1	26.3	33.2	36.2			
Governance	17	73.0	75.7	76.4	71.2	74.2	71.2			
CSR strategy	0	–	–	–	–	–	–			
Management	14	73.3	74.3	74.6	72.7	74.0	70.8			
Shareholders	3	71.6	82.2	84.8	64.4	75.2	73.1			

Note: This table reports the proportion of valid values in numeric indicators for each region in the Refinitiv database. The sample covers the period from 2010 to 2019.

Table A.2. Proportion of Valid Values in Numeric Indicators by Sectors

Category	Nb of numeric items	2010	2015	2019	2010	2015	2019	2010	2015	2019
		Energy			**Basic Materials**			**Industrials**		
ESG	63	35.2	37.8	39.6	37.5	41.3	42.1	33.6	35.9	36.6
Environment	27	18.1	21.7	26.3	24.8	27.9	30.2	17.9	19.1	20.5
Emission	14	19.2	22.4	25.5	24.9	28.4	29.8	18.8	19.7	20.0
Innovation	7	–	–	–	21.4	19.0	18.5	12.4	10.0	6.8
Resource use	6	15.4	19.9	28.2	25.8	29.8	35.0	16.9	19.6	24.4
Social	19	23.9	30.5	32.8	25.1	33.0	34.8	23.4	29.1	31.0
Community	1	32.7	41.0	39.6	39.8	45.0	50.1	39.5	33.8	34.7
Human rights	0	–	–	–	–	–	–	–	–	–
Product resp.	2	3.2	8.1	10.0	2.6	13.4	14.2	5.1	11.9	11.3
Workforce	16	26.0	32.7	35.2	27.0	34.7	36.4	24.7	31.0	33.2
Governance	17	83.8	83.1	81.8	80.4	81.6	79.8	79.6	80.1	79.3
CSR strategy	0	–	–	–	–	–	–	–	–	–
Management	14	83.8	82.0	80.2	81.0	80.8	78.4	79.0	78.5	77.5
Shareholders	3	83.5	88.0	89.2	77.3	85.6	86.2	82.2	87.5	87.9
		Consumer Cyclical			**Consumer Non Cycl.**			**Financials**		
ESG	63	33.4	35.1	35.8	34.3	35.8	37.0	32.3	33.6	34.0
Environment	27	16.7	16.8	17.4	21.3	21.9	25.2	19.0	21.2	19.6
Emission	14	18.7	18.6	19.0	23.5	22.5	24.6	21.2	23.3	19.7
Innovation	7	12.5	10.4	5.0	7.5	11.3	10.0	–	–	–
Resource use	6	14.8	16.9	21.2	19.7	22.9	29.5	16.3	18.5	19.4
Social	19	22.1	26.9	29.5	24.0	29.1	32.6	27.5	31.0	32.3
Community	1	38.7	34.4	31.1	42.9	37.1	42.8	45.0	42.5	38.7
Human rights	0	–	–	–	–	–	–	–	–	–
Product resp.	2	5.2	12.7	13.8	1.9	10.1	11.3	11.6	12.5	10.0
Workforce	16	23.1	28.2	31.3	25.5	31.0	34.6	27.3	31.5	33.3
Governance	17	80.5	81.0	80.3	80.3	79.6	77.2	81.0	81.3	80.6
CSR strategy	0	–	–	–	–	–	–	NaN	NaN	NaN
Management	14	80.2	79.7	78.6	80.5	78.8	75.8	80.8	80.1	79.3
Shareholders	3	82.1	87.0	88.4	79.4	83.4	83.5	82.0	86.9	86.4
		Health Care			**Technology**			**Utilities**		
ESG	63	35.0	35.5	33.8	33.0	35.3	34.8	39.3	40.1	43.3
Environment	27	23.2	20.1	15.7	18.6	20.7	17.8	23.5	23.7	30.4
Emission	14	25.4	20.2	14.6	20.3	21.0	17.6	28.6	28.2	32.4
Innovation	7	–	–	–	9.2	10.1	5.7	10.5	10.1	21.6
Resource use	6	18.3	19.9	18.1	16.8	22.1	20.8	21.7	23.8	32.6
Social	19	22.2	26.0	25.0	21.2	25.8	27.1	31.9	36.1	42.1
Community	1	30.8	27.4	19.0	26.9	22.1	25.1	60.3	56.8	60.3
Human rights	0	–	–	–	–	–	–	–	–	–
Product resp.	2	3.1	11.8	11.4	3.1	18.7	16.2	10.1	15.1	14.8
Workforce	16	24.1	27.6	27.0	23.1	26.9	28.6	32.9	37.4	44.4
Governance	17	83.0	83.8	82.5	79.9	81.5	80.9	80.7	78.9	75.7
CSR strategy	0	–	–	–	–	–	–	–	–	–
Management	14	82.8	82.3	81.0	79.9	80.1	79.1	80.7	78.1	74.6
Shareholders	3	84.1	90.6	89.5	80.0	87.8	89.1	81.0	82.6	81.3

Note: This table reports the proportion of valid values in numeric indicators for each sector in the Refinitiv database. The sample covers the period from 2010 to 2019.

Table A.3. Proportion of Valid Values in Numeric Indicators by Firms' Sizes

Category	Nb of numeric items	2010	2015	2019	2010	2015	2019
		Small firms			**Medium-small firms**		
ESG	63	30.9	34.1	31.5	33.1	35.1	37.8
Environment	27	9.1	9.9	8.0	15.4	14.4	19.1
Emission reduction	14	10.1	9.6	7.5	15.6	15.0	17.3
Innovation	7	6.6	8.7	8.3	11.9	10.8	22.3
Resource use	6	8.7	11.7	8.9	17.3	15.4	21.0
Social	19	18.2	23.1	21.5	19.7	25.5	28.6
Community	1	30.1	23.2	13.4	28.7	28.1	27.5
Human rights	0	–	–	–	–	–	–
Product resp.	2	3.1	7.4	6.5	4.0	11.2	12.5
Workforce	16	19.3	25.0	23.9	21.1	27.2	30.7
Governance	17	82.2	81.9	81.3	78.8	81.0	80.2
CSR strategy	0	–	–	–	–	–	–
Management	14	82.6	81.2	79.5	78.7	79.6	78.5
Shareholders	3	80.5	85.1	89.6	79.1	87.9	88.1
		Medium-large firms			**Large firms**		
ESG	63	33.0	36.7	39.6	40.8	45.1	48.8
Environment	27	15.3	17.9	23.1	24.9	30.2	35.9
Emission reduction	14	15.6	18.4	22.3	28.2	34.0	36.7
Innovation	7	11.3	10.2	22.5	18.1	19.5	26.5
Resource use	6	17.3	21.8	25.3	24.3	32.0	43.7
Social	19	19.7	27.3	31.8	28.0	34.6	39.9
Community	1	28.9	32.0	44.2	47.7	49.7	56.4
Human rights	0	–	–	–	–	–	–
Product resp.	2	4.0	13.9	14.0	5.9	16.1	18.4
Workforce	16	21.1	28.7	33.3	29.5	36.0	41.5
Governance	17	78.8	80.3	78.1	81.9	82.2	81.0
CSR strategy	0	–	–	–	–	–	–
Management	14	78.7	78.8	76.8	81.6	80.9	79.5
Shareholders	3	79.2	87.3	84.1	83.3	88.0	87.7

Note: This table reports the proportion of valid values in numeric indicators for each size quartile in the Refinitiv database. The sample covers the period from 2010 to 2019.

B Additional Results on Zero Values

Table A.4 indicates that the proportion of firms with a category score equal to 0 across regions. In all regions, we find that the scores for the three E categories suffer from a large frequency of 0.

Table A.5 indicates that the proportion of firms with a category score equal to 0 is also heterogeneous across industries. First, there are large differences regarding the proportion of scores equal to 0. For the E pillar, the proportion of scores equal to 0 is as high as 53% for health care and as low as 17% for utilities in 2019. Heterogeneity in categories is even more pronounced: 90% of the health care firms fail to have one positive answer for the indicators underlying the Innovation score. In contrast, only 18% of utilities obtain an Innovation score equal to 0. We also find the same gap between health care firms and utilities for the Human rights score (S pillar) and the CSR strategy score (G pillar). Financials also report a substantial proportion of scores equal to 0 for some categories. It should be noted that the sectoral heterogeneity is not related to the (lack of) materiality of some indicators, because category scores are already based on indicators that are material at the sector level.

Second, the table reveals that the proportion of firms with category scores equal to 0 tends to decrease over time for most sectors, but this evidence is not universal. Health care reports a higher proportion of scores equal to 0 in 2019 than 2010 for all E and G categories. Technology also reports an increase in the frequency of 0 for the E categories.

Table A.6 reports the proportion of firms with a category score equal to 0 for various size bins.

Table A.4. Proportion of Scores with Zero Value by Region

Category	2010	2015	2019	2010	2015	2019	2010	2015	2019
	World			**North America**			**Europe**		
Environment	17.9	21.0	21.2	24.4	32.9	37.5	5.1	5.7	6.0
Emission	26.6	29.8	28.2	34.6	43.9	46.4	9.8	9.1	9.9
Innovation	56.1	56.6	56.5	62.3	66.0	71.0	40.5	40.2	39.2
Resource use	27.6	29.1	29.4	37.0	43.0	49.8	9.9	11.9	11.2
Social	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Community	0.6	0.0	0.0	0.1	0.0	0.0	1.1	0.0	0.0
Human rights	66.6	55.4	41.9	75.4	64.5	59.4	41.7	30.2	13.7
Product resp.	24.8	17.2	10.0	19.0	11.6	5.9	20.5	13.6	6.6
Workforce	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Governance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CSR Strategy	35.1	36.4	33.9	45.4	57.0	61.1	16.0	12.7	10.0
Management	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shareholders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Pacific			**Emerging countries**					
Environment	19.5	19.1	14.1	19.2	15.1	11.0			
Emission	29.0	28.8	20.7	29.4	24.3	17.9			
Innovation	55.7	55.0	48.3	62.6	55.0	50.7			
Resource use	29.0	27.3	19.1	30.0	21.3	16.4			
Social	0.0	0.0	0.0	0.0	0.0	0.0			
Community	1.2	0.0	0.0	0.5	0.1	0.0			
Human rights	73.9	64.8	38.9	72.3	53.0	37.6			
Product resp.	33.9	22.9	9.3	28.2	23.3	19.7			
Workforce	0.0	0.0	0.0	0.0	0.0	0.0			
Governance	0.0	0.0	0.0	0.0	0.0	0.0			
CSR Strategy	40.1	34.0	21.0	34.7	24.8	16.4			
Management	0.0	0.0	0.0	0.0	0.0	0.0			
Shareholders	0.0	0.0	0.0	0.0	0.0	0.0			

Note: This table reports the proportion of scores with zero values for each region in the Refinitiv database. The sample covers the period from 2010 to 2019.

Table A.5. Proportion of Scores with Zero Value by Sector

Category	2010	2015	2019	2010	2015	2019	2010	2015	2019
	Energy			**Basic Materials**			**Industrials**		
Environment	14.7	12.1	6.0	10.7	7.6	7.0	9.9	13.5	11.6
Emission	22.8	20.2	10.7	20.0	14.1	12.1	19.5	24.4	17.5
Innovation	76.4	75.1	68.7	61.0	56.9	49.7	46.9	44.4	44.0
Resource use	29.6	26.4	19.7	19.6	15.7	14.6	21.8	21.3	18.3
Social	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Community	0.3	0.0	0.0	1.2	0.0	0.0	1.5	0.0	0.0
Human rights	70.4	60.9	39.6	60.8	45.6	29.1	64.0	46.2	29.5
Product resp.	34.4	23.2	13.4	31.8	21.3	13.7	15.8	12.7	7.9
Workforce	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Governance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CSR strategy	32.7	30.2	21.7	25.1	19.5	13.7	28.9	31.4	26.1
Management	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shareholders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Consumer Cyclical			**Consumer Non Cycl.**			**Financials**		
Environment	20.6	20.7	14.5	11.5	14.6	9.4	28.9	34.7	33.6
Emission	31.8	29.7	25.0	19.0	20.5	14.8	35.3	41.9	40.1
Innovation	58.7	58.1	55.6	44.4	49.6	47.7	59.4	60.3	58.2
Resource use	27.5	27.8	23.9	18.0	18.9	14.4	40.6	43.8	45.1
Social	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Community	0.5	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.0
Human rights	60.0	49.9	32.8	56.3	41.9	30.4	78.4	71.8	57.3
Product resp.	27.6	18.6	8.4	10.5	8.7	7.5	30.0	20.5	10.0
Workforce	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Governance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CSR strategy	40.7	38.3	33.9	26.0	24.8	21.4	42.3	43.4	41.9
Management	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shareholders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Health Care			**Technology**			**Utilities**		
Environment	34.6	41.5	53.1	17.5	23.6	26.8	2.7	3.8	1.7
Emission	40.9	51.0	59.0	28.5	34.1	35.4	5.3	7.7	5.2
Innovation	80.3	87.9	90.3	39.7	49.6	58.9	41.0	30.3	17.6
Resource use	38.5	45.5	58.8	26.1	30.7	32.4	13.3	15.0	8.3
Social	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Community	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0
Human rights	69.2	62.5	64.8	62.3	45.4	38.9	62.2	56.8	26.9
Product resp.	18.3	13.0	8.5	14.7	10.3	9.7	17.0	14.1	12.8
Workforce	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Governance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CSR strategy	44.2	54.2	62.7	41.2	45.1	41.6	14.8	18.4	8.6
Management	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shareholders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: This table reports the proportion of scores with zero values for each sector in the Refinitiv database. The sample covers the period from 2010 to 2019.

Table A.6. Proportion of Scores with Zero Value by Firm's Size

Category	2010	2015	2019	2010	2015	2019
	Small firms			**Medium-small firms**		
E Score	27.5	31.9	43.0	23.6	27.9	21.5
Emission Score	43.0	45.7	53.0	36.9	39.5	29.6
Innovation Score	75.0	79.6	79.4	68.0	67.5	61.1
Resource use Score	42.2	43.0	56.2	36.4	39.5	31.4
S Score	0.0	0.0	0.0	0.0	0.0	0.0
Community Score	0.4	0.0	0.0	0.7	0.0	0.0
Human rights Score	82.1	70.3	65.1	79.6	66.2	44.8
Product resp. Score	41.4	31.2	11.8	34.1	20.7	10.2
Workforce Score	0.0	0.0	0.0	0.0	0.0	0.0
G Score	0.0	0.0	0.0	0.0	0.0	0.0
CSR strategy Score	52.0	47.5	60.0	47.9	46.6	38.4
Management Score	0.0	0.0	0.0	0.0	0.0	0.0
Shareholders Score	0.0	0.0	0.0	0.0	0.0	0.0
	Medium-large firms			**Large firms**		
E Score	22.2	23.3	14.2	10.4	10.7	6.4
Emission Score	33.1	31.9	21.3	14.8	15.9	9.4
Innovation Score	59.6	58.2	50.4	44.5	40.1	35.6
Resource use Score	33.0	31.7	21.4	17.2	15.3	9.1
S Score	0.0	0.0	0.0	0.0	0.0	0.0
Community Score	0.8	0.0	0.0	0.6	0.1	0.0
Human rights Score	74.7	59.4	38.0	53.1	39.8	20.2
Product resp. Score	27.4	18.7	12.5	16.4	9.1	5.8
Workforce Score	0.0	0.0	0.0	0.0	0.0	0.0
G Score	0.0	0.0	0.0	0.0	0.0	0.0
CSR strategy Score	43.9	40.7	25.8	20.2	22.0	12.3
Management Score	0.0	0.0	0.0	0.0	0.0	0.0
Shareholders Score	0.0	0.0	0.0	0.0	0.0	0.0

Note: This table reports the proportion of scores with zero values for each size quartile in the Refinitiv database. The sample covers the period from 2010 to 2019.

C Additional Results on Average Scores

Table A.7. Average Scores by Firm's Size

Category	2010	2015	2019	2010	2015	2019
	Small firms			**Medium-small firms**		
ESG Score	30.0	30.6	29.9	31.2	34.3	38.9
E Score	20.0	18.1	13.7	21.8	22.5	26.7
Emission Score	22.1	19.4	15.4	24.4	24.8	30.2
Innovation Score	11.2	8.0	8.8	13.3	15.3	17.7
Resource use Score	22.9	21.2	15.2	24.9	24.4	29.3
S Score	29.4	31.0	32.9	29.7	34.7	40.9
Community Score	41.8	39.2	41.5	41.1	43.5	46.0
Human rights Score	7.7	12.5	14.8	9.1	14.5	24.5
Product resp. Score	26.2	29.9	36.1	28.4	34.4	42.3
Workforce Score	40.6	41.5	34.9	39.8	42.2	46.2
G Score	41.1	41.6	38.5	41.5	43.2	45.4
CSR strategy Score	20.1	21.2	14.3	20.5	22.0	25.9
Management Score	43.8	44.1	40.2	44.3	45.6	48.3
Shareholders Score	46.2	46.9	48.8	46.3	49.0	48.8
	Medium-large firms			**Large firms**		
ESG Score	35.8	38.6	44.1	49.4	52.2	58.0
E Score	27.1	28.1	34.5	43.9	46.0	52.8
Emission Score	29.6	31.2	38.5	49.6	50.7	59.7
Innovation Score	19.6	19.7	24.5	29.6	32.4	35.9
Resource use Score	29.4	30.5	37.3	48.5	51.8	59.4
S Score	34.1	38.9	44.6	48.6	53.2	60.3
Community Score	44.8	46.7	48.8	57.9	60.5	64.1
Human rights Score	11.4	19.0	30.4	25.1	33.4	47.0
Product resp. Score	33.2	39.0	43.6	46.6	52.3	57.6
Workforce Score	44.0	46.3	52.0	60.8	61.5	67.8
G Score	44.8	46.0	49.9	54.3	54.8	57.7
CSR strategy Score	24.7	27.1	36.4	45.6	46.0	55.8
Management Score	47.9	48.7	52.3	56.0	57.2	59.8
Shareholders Score	47.8	49.7	51.1	54.4	53.0	51.9

Note: This table reports the average scores for each size quartile in the Refinitiv database. The sample covers the period from 2010 to 2019.

PUBLICATIONS

Deconstructing ESG Scores: How to Invest with your own Criteria?

Working Paper No. WP/2023/057