European corporate sustainability reporting - The Financial Materiality Compass as an auxiliary tool

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Abstract

European companies in scope of the new Corporate Sustainability Reporting Directive (CSRD) will have to report on all sustainability topics that are either financially-material or impact-material (or both) to them. Determining materiality in an extensive individual analysis, however, proves to be an expensive undertaking that will encumber resource-constrained and smaller companies in particular. To offer an easily applicable auxiliary tool, we create a comprehensive sector-specific Financial Materiality Compass (FMC) along the lines of the European Sustainability Reporting Standards (ESRS). The FMC relies on an extensive three-step analysis where we combine panel regression results on financial performance data with self-identified materiality assessments from large corporations and expert interview evaluations in a European setting. We find that for companies in the consumer staples and energy sector nine out of 10 ESRS categories are financially material, but only one, respectively two, of these categories show a strong materiality. For companies in the health care, information technologies and real estate sector, in contrast, we report the lowest number of financially material ESRS categories in total. Against the backdrop of significant reporting costs, our results hence provide companies with a robust, science-based orientation in determining their sustainability reporting requirements and corresponding data collection needs.

Keywords: CSRD, ESRS, sustainability reporting, financial materiality

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1. Introduction

In 2018, the EU released the "Action Plan: Financing Sustainable Growth" which intends to channel capital flows in a sustainable direction via 10 different measures. Chief among them is the provision to increase the transparency of sustainability in economic activities (European Commission 2018). The Sustainable Finance Disclosure Regulation (SFDR), for instance, which became effective in spring 2021, requires financial market participants to disclose sustainability information about investment products to end investors. To provide this information, however, it is necessary that the issuers of the securities that form the basis of these investment products report on their sustainability activities as well. So far, the respective corporate disclosures are not sufficiently detailed to allow financial market participants to fulfill the requirements of the SFRD in a precise manner (European Parliament 2019).

The Corporate Sustainability Reporting Directive (CSRD) attempts to address this issue. From 2024 onwards, this directive significantly increases the number of firms that must report and raises the amount of sustainability information that companies have to publish (European Parliament 2022). With regard to scope, the CSRD for the first time also requires privately held and smaller firms to report on their sustainability activities, bringing the number of affected companies to about 49.000 in the EU. Concerning content, the newly-developed European Sustainability Reporting Standards (ESRS) (European Commission 2023a) make the information demands very explicit by covering 10 thematic sustainability categories: five *environmental*, four *social* and one *governance*-related category. Each of these categories contains many different metrics, so that the standards in total stretch over several hundred reportable data points (European Commission 2023b).

According to the CSRD, companies mandatorily have to report on all those ESRS categories that are either financially and / or impact-material for them (European Parliament 2022). Financial materiality arises if a sustainability issue has an effect on the cash flows or revenue generation of a firm ("outside-in" view). Impact materiality is established if the company and its downstream or upstream activities show an effect on sustainability factors ("inside-out" view). This concept of "double materiality" is specific to the European sustainable reporting approach (European Commission 2022). Other countries such as the US refer solely to the concept of financial materiality that underlies also all manners of financial reporting for publicly-listed firms (SEC 2023). As the CSRD applies also to privately held companies, however, there are many firms in its massively enlarged scope for which both the concept of financial materiality and of impact materiality are new.

While the CSRD recommends the running of an extensive, full-fledged materiality analysis to determine the individual materiality for each company, this may easily exceed the resources particularly of the smaller firms in the new regulation's scope: For both the financial and impact materiality assessment, it might be necessary to

identify and conduct extensive interviews with a large number of different stakeholders. Given the novelty level and the enormous degree of detail within each of the ESRS categories, not all of these stakeholders may be true experts in all of the various interview areas. This may easily render the results of such individual materiality assessments unreliable or biased unless an incredible effort is made. In addition, the ensuing data collection costs for each of the sustainability issues to report on are clearly non-negligible. Particularly for resource-constrained firms, it is therefore of utmost importance to determine the material sustainability topics with as much certainty as possible in order to keep reporting expenses at a reasonable level.

This is exactly where our work tries to contribute: We attempt to build a Financial Materiality Compass (FMC) that assesses the financial materiality of each ESRS category for firms in 11 different sectors. We focus explicitly on financial materiality and rely on a rigorous three-step approach to derive the degree of financial materiality (strong, weak or not-existent) of the various sustainability categories laid out in the ESRS for European firms in different sectors. Our results show that not all of the 10 ESRS sustainability categories are financially material to all sectors. Further, we find that while a large number of sustainability topics have weak financial materiality for companies from different sectors, only a few sustainability categories show strong financial materiality. Even the categories that were proposed as mandatory to report in a first draft of the standards, *E1 climate change* and *S1 own workforce*, show strong financial materiality in less than half of the sectors.

To identify the financially material sustainability topics for European companies, our analysis follows a three-step approach. The first step involves a panel data regression analysis on financial performance data from 1,914 European companies between 2010 and 2021. We group companies according to the Global Industry Classification System (GICS®) into 11 sectors (MSCI and S&P Global 2023). For each sector subsample, we run panel regressions of nine different return and equity risk measures on various sustainability scores. Based on our regression results, we determine the degree of materiality depending on the significance of the sustainability scores as explanatory variables in the nine regressions per sector. We then group the results of the individual sustainability scores into broader topics that match the 10 ESRS categories. This procedure delivers a first-step FMC.

In a second step, we manually analyze the sustainability reports of 293 publicly listed European companies. More precisely, we examine the materiality assessments of these companies, which are often provided in the form of a materiality matrix. We focus solely on the financial materiality dimension and assign the degree of materiality based on whether topics are mentioned to be above-average or below-average relevant for the firm, or are not mentioned. In order to match the topics to the ESRS categories, we rely on the textual information and KPIs provided in the standards themselves (European Commission 2023b). Building sector averages of the categories' materiality assessments allows us to build a second FMC. We then combine the FMC from the regression

analysis and from the sustainability report analysis by weighting the results by 2/3 and 1/3, respectively. The lower weighting of the sustainability report analysis is due to suspected potential biases as this is a non-audited and self-identified reporting outcome.

The third and final step of our analysis overlays the results derived so far with the views of experts that we collected via structured interviews. More precisely, we contacted seven experts in the area of ESG investing, corporate governance and financial analysis and completed comprehensive interviews with all of them. The experts provided comments and were able to shift the materiality intensities of the combined FMC from steps one and two. On this basis, we created a separate compass for each expert. Using the mean values regarding the materiality assessments of these seven compasses, we developed our final FMC.

The final version of the FMC shows that ESRS categories *E1 climate change, S1 own workforce,* and *G1 business conduct* are at least weakly financially material for all sectors. However, our results show strong financial materiality for these categories in only four to five of the 11 sectors. Stated differently, even these heavily discussed sustainability categories do not possess strong financial materiality for more than half of the sectors considered. Furthermore, the FMC shows clear differences with regard to the most financially material sustainability categories per sector: In the consumer staples and energy sectors, we find nine topics to have at least a weak financially material impact. Of these, however, only three (*E1 climate change, E4 biodiversity and ecosystems,* and *S2 workers in the value chain)* in the consumer staples sector and only one (*E1 climate change)* in the energy sector have a strong financial materiality. In the real estate sector, in contrast, only four out of the 10 sustainability categories are financially material, among them only *G1 business conduct* with strong financial materiality.

The FMC also shows that some ESRS sustainability categories are clearly less often material than others. For instance the categories *E3 water and marine resources* and *S3 affected communities* show financial materiality in only 4 sectors. Topics *E2 pollution, E3 water and marine resources, E4 biodiversity and ecosystem,* as well as *S4 consumers and end-users* do not have a strong financially material impact in any of the 11 sectors. For these categories, we find only weak financially material impacts.

Our results are intended to serve as a science-based orientation for companies who are resource constrained and either cannot run an extensive, full-fledged materiality analysis for their CSRD reporting, would like to validate their findings from an initial analysis or would like to begin their individual analysis from a more informed starting point. As the business models of companies even in the same sector can vary significantly, our compass clearly cannot provide a universally applicable or final statement with regard to the financially most material sustainability topics. In addition, in order to derive as robust results as possible, our analysis stretches over a relatively coarse sector segregation. Companies may therefore see the need to adjust our findings to their

individual situation. However, we believe that the FMC at least provides a robust and scientifically verifiable basis for such individual adjustments.

The remainder of this paper is structured as follows: Section 2 presents the relevant background and related literature to our study. Section 3 describes the samples used and constructs the underlying variables. Section 4 outlines the methods employed in the various analyses. Section 5 presents the results, which are discussed in more detail in Section 6. Section 7 concludes.

2. Background and related literature

The CSRD significantly expands sustainability reporting requirements for European companies as compared to the earlier Non-Financial Reporting Directive. This includes a significant extension of the companies obligated to report on sustainability topics. Most importantly, however, the CSRD is much more specific than the earlier directive with regard to the content that needs to be reported. To this end, the development of the ESRS was commissioned via the European Financial Reporting Advisory Group (EFRAG) (European Parliament 2022). After several revisions of the EFRAG drafts through various consultation processes, the EU published the final applicable ESRS on July 31, 2023. These standards are mandatory for companies falling under the CSRD. In addition to cross-cutting issues laid out in *ESRS 1 general requirements* and *ESRS 2 general disclosures*, the ESRS consist of 10 topic-specific standards categorized into *environmental, social,* and *governance* areas (European Commission 2023a). These fall under the restriction of a materiality assessment such that firms need to report on each of the categories if this topic is either financially or impact material or both (European Commission 2023b).

As companies worldwide perceive the advantage of reporting on sustainability issues also on a voluntary basis, various organizations have started to offer guidance on how to identify material sustainability topics (Kaiser 2020). The most well-known materiality assessment provider is the Sustainability Accounting Standards Board (SASB). Similar to our work, SASB focuses solely on financial materiality and determines the most material sustainability topics for 77 industries. The sustainability issues that are assessed comprise 26 different topics from five categories: environment, social capital, human capital, business model & innovation, and leadership & governance. SASB's materiality map is derived from several analytical processes, including evidence-based science, feedback from market participants such as companies or investors, and the opinion of SASB's independent Standards Board (SASB 2023). In contrast to our FMC, however, SASB's materiality map is based mainly on US corporate data. As a consequence, it strongly reflects the industry split that is represented by US companies and that tends to be very different from the European sector split, with the former being much more affected by technology

firms and the latter much more by industrial companies. In addition, SASB's materiality map refers to very different sustainability categories than the ESRS, with a potential matching between the two being less than straightforward. Finally, even the financial materiality assessments themselves may turn out to be different in the US as compared to the European context due to the different perspective that US investors take on sustainable investing as compared to European investors (Bannier et al. 2023).

In accordance with SASB's materiality map, our analysis also focuses on financial materiality. It has been well-established in the literature that the financial materiality of sustainability topics for a company strongly depends on the specific sector it operates in (Eccles and Serafeim 2013; Khan et al. 2016). This allows us, in line with the approach by SASB, to identify the financially material sustainability topics for the 11 sectors of the GICS®. In contrast to SASB, however, the sustainability topics in our compass are directly aligned with the 10 ESRS categories. Furthermore, the determination of material aspects is exclusively tailored to the European context since the underlying data is entirely based on European companies.

3. Samples and variables construction

3.1 Samples

We use two different samples for the derivation of the FMC. The first sample employed for the regression analyses consists of 1.914 publicly listed European companies that received at least one sustainability rating from Refinitiv for the time period 2010-2021.[1] It should be noted that the number of companies rated by Refinitiv is steadily increasing over time as more and more stock market indices are included in Refinitiv's rating universe. Refinitiv has started early on to evaluate companies regardless of whether they disclose a sustainability report by relying also on other sources of information such as websites of non-governmental organizations. Therefore, Refinitiv's selection bias is reported to be smaller compared to other rating agencies (Desender and Epure 2015), which makes their data attractive to use for our purposes.

Table 1 shows the breakdown of firms by their country of headquarters. The largest number of firms in the sample have their headquarters in Sweden, followed by Germany and Switzerland. Table 2 shows the firm distribution per sector. The largest fraction of companies in our sample is made up of industrials, followed by financial services, health care, information technology and consumer discretionary firms.

[1] Companies originating from the United Kingdom were excluded from our analysis. However, we have deliberately included all other companies located on the European continent in our sample even if their country of origin does not belong to the European Union (e.g. Switzerland). The reason for this is the geographical proximity and high degree of interdependence among the companies in the European Union.

The second sample employed in the sustainability report analysis consists of 294 publicly listed firms in Europe that publish a sustainability or non-financial report. We exclude companies that do not disclose a clear materiality identification or materiality matrix in their reports. Table 3 presents the firm distribution in this sample structured by capital market index membership. We choose the index membership as basis for inclusion into our sample, as most large publicly-listed firms in the EU capital market are required to publish a sustainability report under consistent EU regulation. We collected and evaluated the reports by hand in March and April 2023. The information compiled in this analysis hence refers to the most current sustainability information available to date, mostly for the reporting year 2022, in rare cases also for 2021. As can be seen from Table 3, the majority of companies in the second sample comes from Germany, followed by France and Spain. Table 4 shows the firm distribution grouped by the 11 sectors. Similar to the first sample, the majority of companies in the second sample belong to the industrials sector, while the fewest companies are found in the energy sector.

3.2 Variables construction

Dependent variables

The regressions in the first step of our analysis set out to test for an association between the sustainability scores reported by Refinitiv and various measures of firms' financial performance per sector considered. The association, captured via the significance of the regression coefficients, is meant to proxy for the financial materiality that we attempt to identify. More precisely, we employ nine dependent variables (return and risk measures) with data on them obtained again from Refinitiv.

Among the return measures, we consider both accounting-based and market-based return rates. With regard to accounting returns, we use return on assets (*ROA*), return on equity (*ROE*), and return on sales (*ROS*). *ROA* is calculated by dividing net income after tax by total assets. For *ROE*, we divide net income after tax by shareholders' equity. *ROS* is composed of earnings before interest and taxes divided by net revenue. The market-based return rates include *Tobin's Q*, price-earnings ratio (*PE*), and dividend yield (*DYield*). As *Tobin's Q,* we divide the company's market capitalization by total assets. The *PE* ratio is defined as the company's current share price relative to its earnings per share and is taken directly from Refinitiv (Refinitiv 2020). We calculate the *DYield* as annual dividends per share in relation to the price per share.

Finally, we use three different measures of equity risk. These include volatility (*Vol*), value at risk (*VaR*), and conditional value at risk (*CVaR*). We calculate the annual share price volatility on the basis of daily share price returns. In contrast to this standard measure of equity risk, we use *VaR* and *CVaR* to quantify extreme risks. The *VaR* indicates the maximum loss of an asset within a fixed period of time for a previously specified confidence

interval (Jorion 2007). In our analysis, we use *VaR* at the 5% confidence level. To calculate it for each year, we look at the distribution of daily stock price returns within one year. *CVaR* is the average of all stock price returns that are lower than *VaR*. Since *VaR* and *CVaR* quantify the most negative returns of a company within a year, they have negative values. To make them comparable to the volatility as standardized risk measure and to facilitate the interpretation of results, we multiply *VaR* and *CVaR* by -1 for our analysis. This leads to positive values for all risk measures in our analysis, where a lower measure indicates a smaller risk. Due to outliers, we winsorize all nine dependent variables at the 1% level.

Explanatory variables

To approximate the effect of sustainability issues on a company's financial development, we follow the earlier literature and use Refinitiv's 10 sustainability category scores (Ioannou and Serafeim 2012; Cheng et al. 2014; Breuer et al. 2018; Dorfleitner et al. 2018; Dyck et al. 2019; Jackson et al. 2020; Dai et al. 2021; Flammer 2021; Bannier et al. 2023). Refinitiv publishes sustainability ratings for more than 12,500 companies worldwide. This covers over 85% of the global market capitalization. Refinitiv's sustainability data go back to 2002, collecting more than 630 different sustainability KPIs for each company. These are grouped into 186 sustainability metrics, which are directly comparable between firms (Refinitiv 2022). These metrics are again grouped into 10 categories of which three refer to the environmental area, four to the social area and three to the governance area. For each of these categories, Refinitiv calculates and publishes a separate score per company. These category scores form the basis for the environment, social, and governance topic scores, from which, in turn, the overall ESG rating of a company is calculated (Refinitiv 2022).

The environment area includes the category scores *resource use (RUse), emissions (Emission),* and *innovation (EInnovation).* The social area comprises the categories *workforce (WForce), human rights (HR), community (Comm),* and *product responsibility (PRes)*. Governance contains the categories *management (Mgt), shareholders (SH),* and *CSR strategy (CSRStrat).* These sustainability scores are typically updated annually after the publication of the companies' sustainability report. Refinitiv publishes the categories' scores in the form of a percentile score ranging from 0 to 100. A higher value represents a better sustainability performance (Refinitiv 2022).[2]

[2] It should be noted that Refinitiv overwrites its historical sustainability scores due to reclassifications and restatements. These overwrites go back as far as 5 years into the past and make it difficult to work with historical data that stretches over longer periods (Refinitiv 2021). Moreover, after overwriting, a discernible positive link has been found between a company's sustainability scores and its stock price performance, which does not exist before the overwriting (Berg et al. 2021). To address the problem of uniform availability of *ESG* scores, Refinitiv has introduced the possibility of point-in-time data in 2021. These data allow the uniform use of the same sustainability scores (Refinitiv 2021). In our analysis, scores for the 5 years from 2017 to 2021 are affected by this issue. Despite the problems involved, we decided against using the point-in-time data. The reason for this is that we want to capture the most current knowledge on changed accounting methods, etc., for assessing sustainability performance.

For ease of interpretation, we transform the Refinitiv sustainability scores as our explanatory variables so that they range from 0.00 to 1.00 in our analysis.

Table 5 displays the number of reported sustainability category scores for the 1,914 companies in our first sample. We observe a continuous increase in the number of observations, following Refinitiv's growing rating scope over time, until the year 2020, with a particularly strong increase between 2017 and 2018. The year 2021, in contrast, shows a slightly smaller number of observations, which is caused by the fact that Refinitiv has not published the category scores for 2021 for all companies in our sample at the time of data collection in November 2022.

Control variables

In order to control for the effect of other factors on financial performance, we include various company-specific variables in our regressions following the previous literature (Breuer et al. 2018; Pawliczek et al. 2021; Bannier et al. 2023). To control for the influence of company size, we use the natural logarithm of sales (*ln_Sales*) as well as the number of employees in a company on an annual average (*EMP*). As a proxy for a company's capital structure, we use leverage as total liabilities divided by total assets (*DARatio*). To control for a company's growth opportunities, we use the market-to-book ratio (*MTB*) as the total market value of equity in the form of market capitalization divided by the book value of equity. Due to outliers, we winsorize the control variables at the 1% level. For a more detailed description of all variables used in the regression analysis, see Table A.1 Panels A-C in Online Appendix A.

Sustainability report variables

In the analysis of sustainability reports in step two, we use 10 variables that align directly with the 10 topic-specific standards of ESRS. In the environmental domain, these standards are *E1 climate change, E2 pollution, E3 water and marine resources, E4 biodiversity and ecosystems,* and *E5 resource use and circular economy*. In the social domain, these are the standards *S1 own workforce, S2 workers in the value chain, S3 affected communities,* and *S4 consumers and end-users.* In the governance domain, the standard is *G1 business conduct* (European Commission 2023a). For each company, we attach values of either 0, 1, or 2 to each of the ESRS category variables depending on how the company itself assesses the financial impact of the various sustainability categories

Furthermore, in doing so, the Refinitiv sustainability scores also match the methods and viewpoints contained in step two and three of our analysis, which are based on the most recent materiality assessments of companies and ESG experts.

in its sustainability report. Section 4.2 provides a more detailed description of the procedure and Table A.1 Panel D in Online Appendix A gives a full description of the sustainability report analysis variables.

4. Methodology

4.1 Regression analysis

Cross-sectional data analyses such as ours often give rise to endogeneity issues. These may be caused by omitted explanatory variables, reverse causality between dependent and explanatory variables or measurement errors. Endogeneity problems can lead to inconsistent estimates if not appropriately addressed (Roberts and Whited 2013). To mitigate these concerns, our estimation procedure uses different techniques. First, to reduce omitted variable biases, our regressions incorporate a large number of firm-specific control variables to capture the effect of additional factors on the dependent variables. Second, to alleviate reverse causality or simultaneity issues, we employ the Arellano-Bover/Blundell-Bond estimator for linear dynamic panel data estimations in our regression model (Arellano and Bond 1991). This so-called system generalized method of moments (GMM) estimation attempts to reduce reverse simultaneity effects by employing lagged versions of the dependent variables as instruments to construct the moment conditions and thereby mitigate the effect of time-varying omitted variables (Blundell and Bond 1998). [3] Third, we employ robust standard errors in our regression model to reduce heteroscedasticity-related issues. Hence, our regressions are based on the following fundamental regression model:

$$\gamma_{i,t} = \beta_1 \gamma_{i,t-j} + \beta_2 x_{i,t} + \beta_3 w_{i,t} + v_i + \varepsilon_{i,t} \quad (1)$$

In this context, $\gamma_{i,t}$ represents the dependent variable. In our case, this pertains to the nine return and risk metrics. $\gamma_{i,t-j}$ is the lagged dependent variable employed as explanatory variable in the system GMM estimation. $x_{i,t}$ contains the explanatory variables, which are the 10 different sustainability category scores. The coefficient β_2 thus represents our parameter of interest: It captures the economic and statistical significance of the sustainability effects on the financial performance of a company and in this sense approximates their financial materiality. $w_{i,t}$ represents a vector of the control variables used. The panel-level effects are captured by v_i, and $\varepsilon_{i,t}$ represents the idiosyncratic error term in the regression.

We estimate the nine regression models separately for each of the 11 sectors. In total, this yields 99 regression models. The results of these regressions are used to develop a first-step FMC. To derive the degree of

[3]The Arellano-Bover/Blundell-Bond estimator is estimated using the xtdpdsys command in Stata. We employ the following specifications: lags(1), vce(robust). A more detailed description of the Arellano-Bover/Blundell-Bond estimator and its derivation is provided in Online Appendix B.

financial materiality of each sustainability score per sector, we focus on the number of significances that the regression coefficients of each individual score show across all nine regressions. It should be noted that the sign of the coefficients, i.e. the direction of the effect, is disregarded. This is because material sustainability topics in a company can have either positive or negative effects on its financial performance.

More precisely, we collect the number of significances that the coefficients of each sustainability category score variable shows across all nine regressions for each sector sample. We consider all significances from a level of 10% or lower. Based on this count of significances, we assign numerical values of zero, one, or two to the category scores. A value of zero, representing no materiality, is assigned to categories that show no, one, or two significant coefficients in the nine regressions per sector. We assign a value of one, representing low materiality, to categories that exhibit significant coefficients exactly three times in the nine regressions. A value of two, indicating high materiality, is assigned to categories with four or more significances across the nine regressions.[4]

In a next step, we match Refinitiv's sustainability category scores to the 10 ESRS categories. To do so, we follow Table 6 and use the mapping procedure described there. This matching is based both on Refinitiv's description of the individual sustainability category scores as well as the contents and verbal descriptions of the ESRS thematic standards. As can be seen, most Refinitiv sustainability categories are uni-directionally mapped into corresponding ESRS categories. However, Refinitiv's *emission* category is defined very broadly and is therefore mapped both into *E1 climate change, E2 pollution* and *E4 biodiversity and ecosystems*. Contrary to this, Refinitiv's categories *innovation* and *shareholders* do not map with any of the ESRS categories. The corresponding regression results are therefore disregarded for the development of the first-step FMC. Finally, two Refinitiv categories (*CSR strategy* and *management*) are mapped into one ESRS category (*G1 business conduct*). For this purpose, we used the mean value of the significances of these two categories. Based on the results of this matching, we obtain the first-step FMC.

4.2 Sustainability report analysis

In the second step analysis, we manually evaluate the most recent sustainability reports from 293 European companies. We focus primarily on the materiality matrices as sources of information. These matrices usually present various sustainability topics and sort them according to their degree of financial and impact materiality on the two axes. We extract solely the financial materiality intensities and assign a value of two to topics that are clearly

[4] We discuss the robustness of the assignment of materiality intensity according to the number of significances in Section 5.1.3.

described as highly or above-average material, a value of one to topics of lower or (below-) average materiality and zero to topics that are not material for the company.

For companies that do not disclose a materiality matrix, we assess the materiality of the listed topics based on their textual descriptions in the sustainability report. We start by collecting all sustainability items mentioned and count the frequency of them being mentioned in the text. We next assign a value of two (one) to all items that are mentioned with an above- (below-) average frequency and zero to those that are described as not material. In cases where a company does not provide a materiality intensity classification but still lists and extensively describes certain sustainability topics, we assume that all mentioned topics are of high financial materiality. We exclude companies from the analysis if they do not clearly describe their materiality identification process.

We next match the sustainability topics mentioned in the companies' materiality matrices or sustainability reports to the ESRS thematic categories, based on the content description and key performance indicators given in the ESRS standards. In cases where several topics can be matched to one category, we calculate the average of the assessed materiality values of these topics and assign this average to the respective ESRS category. Table A.2 in Online Appendix A entails a more detailed description of this matching procedure.

In order to aggregate these assessments into the sector-specific financial materiality compass, we calculate the average materiality assessment per ESRS category for all the firms in each of the 11 sectors. These sector-based mean materiality values per ESRS category then form the second-step FMC that is created specifically from the sustainability report analysis.

4.3 Final financial materiality compass development

In the following analytical step, we merge the results of the regression analysis with the results of the sustainability report analysis and create a combined FMC. This merger is done via a simple weighted average where the results of the regression analyses contribute two thirds, while the results of the sustainability report analysis contribute one third. We choose a higher weighting of the regression results for two reasons. The first is a purely statistical aspect: The regression analysis relies on a much larger number of observations which strongly reduces the standard errors of the estimated materiality assessments. The second is a potential lack of verifiability of the self-identified materiality assessments. More precisely, we are concerned with potential biases in these assessments as even large, publicly-listed firms are not always fully experienced in conducting these analyses and because the sustainability reports are usually not (yet) audited. There is hence no quality assurance on the information provided so that we feel more comfortable in taking a slightly more conservative perspective by underweighting the results from this part of our analysis.

In a final analytical step, this combined FMC is then subject to a further robustness check via structured interviews that we run with seven financial ESG experts. These experts are practitioners from the asset management industry, financial and ESG analysts and corporate governance experts. We present them with the combined FMC and allow them to shift the materiality intensities if they feel this is necessary. In structured interviews we ask them for comments regarding the shifts and allow for a shift to persist only if a verifiable argument is provided. More specifically, in these interviews we present the combined FMC to the experts separately for each sector. We ask the experts whether they agree or disagree with the materiality intensities shown. In the event of rejection and a request for change in materiality, we ask for a justification. If sufficient and objectifiable justification is provided, we adjust the materiality levels for the respective category accordingly. Based on these interviews, seven new FMCs are compiled, depending on the changes made per expert, which we eventually aggregate by building simple averages out of the materiality assessments per sector and ESRS category. The table containing these average financial materiality assessments is our final FMC.

5. Results

5.1 Regression analysis

5.1.1 Descriptive statistics

Table 7 presents the descriptive statistics of our first sample. Panel A shows the dependent variables of our estimation models. It should be noted that the large variation in the number of observations is caused by the relatively high number of missing data, particularly with regard to *PE* and *DYield*. For the explanatory variables in Panel B, all categories except *EInnovation* and *CSRStrat* show a median score larger than 0.5. The companies in our sample hence achieve at least a good median performance in terms of these sustainability categories. The highest median sustainability scores are found in the social dimension, which is comparable to earlier work on European data (Bannier et al. 2023). The *WForce* score stands out in particular with a median value of 0.733. The *DARatio* of the control variables in Panel C shows that the companies in our sample finance 58.3% of their assets with debt. Among the control variables *Emp* shows a particularly higher number of missing values. This is due to the unavailability of employee count data for some companies. Nonetheless, the median value of 2,551 employees demonstrates that our sample consists mainly of large companies.

5.1.2 Regression results

Tables A.3 to A.13 in Online Appendix A present the results of the nine system GMM estimations for the 10 individual sectors, where each column shows the usage of a different return or risk variable as dependent variable. Before we attempt to approximate the materiality of the individual sustainability categories per sector from the

significances of their estimated regression coefficients, it is important to assess the quality of the estimations per se.

Based on the test statistics reported in the tables, weaknesses can only be detected for very few models per sector. More precisely, there are issues with model (2) in the communication services sector, with model (3) in the materials sector and with model (5) in the consumer discretionary, energy and financial sector. The p-values of the Wald chi2 tests in these models are all above the 5% level. Therefore, these five regressions are not interpretable, as we cannot reject the null hypothesis that the parameters show no significant differences. Given that these weaknesses affect only 5 out of 99 regressions, we resolve to treat this issue in the most conservative sense and interpret the corresponding regression coefficients as not significant and hence assign no materiality in these cases.

In order to summarize the results from the regression analyses in a digestible format, Table 8 reports the sole information of interest from all 99 regressions: the number of significances (for both the 1%, 5% and 10% level of significance) derived from the system GMM estimations for each of the sustainability categories, individually for each sector. The presented results show that the number of significant categories differs strongly across the different sectors. This is an initial indicator that different sustainability categories have varying degrees of financial materiality intensities across different sectors. More precisely, our regression results deliver in total 27 statistically significant regression coefficients from the nine regressions in the consumer discretionary sector, followed by 26 significant coefficients in the industrials sector. The next largest count numbers of significances are observed in the consumer staples, utilities and real estate sectors. It should be noted that these count data do not distinguish between different levels of statistical significance nor between the sign of the coefficients. Instead of the statistical level of significance and the direction of the effect that a sustainability category may have, we believe that it is of greater interest to consider the question whether any significant sustainability effect is persistent across several financial performance variables. We therefore simply examine the number of significances per sustainability category in each sector.

5.1.3 First-step financial materiality compass

Based on the number of significant coefficients per sustainability category and sector, we now proceed to develop the first-step materiality compass. Since the FMC refers to the ESRS thematic categories, we first map the sustainability categories from Refinitiv (on which the regressions are based) to the ESRS categories as described in Section 4.1.

We assign numerical values of zero, one, or two to each cell in the FMC based on the count of significances per ESRS category and sector. A value of zero, representing no materiality, is assigned to categories that

show up to two significances in the nine regressions per sector. We assign a value of one, i.e. weak materiality, to categories that exhibit significant coefficients exactly three times in the nine regressions. A value of two, i.e. strong materiality, is assigned to categories with four or more significances across the nine regressions.

Table 9 presents the first-step FMC, based on the regression results. As can be seen, there are no ESRS categories that show strong financial materiality for each and every sector. Surprisingly, it is ESRS category *S2 workers in the value chain* that shows the largest frequency of financial materiality over the different sectors in total. However, only one of these is a strong materiality. In contrast, ESRS categories *E1 climate change, E2 pollution, E4 biodiversity and ecosystems* and *G1 business conduct* show a rather small number of material effects across the sectors overall, but still display the largest number of strong materiality effects.

If we consider the different sectors, in contrast, we find the largest number of material ESRS categories for the consumer discretionary and the industrials sector. In both, *E1 climate change, E2 pollution, E4 biodiversity and ecosystems,* and *G1 business conduct* show strong materiality and *S2 workers in the value chain* weak materiality. In addition, *S3 affected communities* is strongly material in the industrials sector and *S1 own workforce* is weakly material in the consumer discretionary sector. In contrast, there are no financially material ESRS categories for the sectors of energy and health care. They show neither strong financial materiality topics nor moderate financial materiality topics. Our first-step FMC, based on the empirical association between sustainability categories and firms' financial development via regressions, hence shows many white spots with regard to the financial materiality of ESRS reporting categories.

It should be noted that changing the materiality definition by shifting the significance count thresholds would result in a change to the first step FMC. A loosening of the thresholds in the form of no materiality at zero and one significance, weak materiality at exactly two significances and high materiality from three significances on would lead to a clear increase in the number of material topics. In total, 21 topics across the 11 sectors would change from no materiality to weak materiality. A total of 12 topics across the sectors would change from weak materiality to high materiality. A weakening of the materiality thresholds would therefore result in an increase in the materiality of 33 of the 110 cells of the FMC. Nevertheless, we opted for the stricter variant, as we believe that assigning a weak materiality in case of three significances out of nine possible significances provides more robust results than in case of two significances. The reason for this is that by considering significances also at the 5 and 10% level, and not only at the much stricter 1% level, our assessment is already quite lenient in this regard. Furthermore, the average number of significances in our regressions lies at two per sustainability topic. Given the large number of cases where there is no significance at all, this average is clearly biased downwards. In order to

achieve a certain robustness with regard to the materiality assessment per topic, we believe that this is more reliably captured by a significance count that is higher than this downwardly-biased average.

5.2 Sustainability report analysis and second-step financial materiality compass

The analysis of self-identified sustainability topics in firms' sustainability reports and their matching into the ESRS categories automatically gives a second-step FMC as presented in Table 10. As becomes immediately evident, this analysis shows a much larger number of categories having an either weak or strong financially material impact on the different sectors as compared to the first-step FMC in Table 9. Surprisingly, *E1 climate change* is considered strongly financially material in all 11 sectors. In contrast, this was the case for only two sectors in the regression analysis. Furthermore, particularly categories *E4 biodiversity and ecosystems,* and *E5 resource use and circular economy* from the *environmental* category are considered material by many more sectors compared to the regression analysis.

A similar trend emerges with regard to the social area. Indeed, all four social categories are considered at least weakly material by all sectors. Category *S1 own workforce* is even considered highly material by all sectors. The same holds for *G1 business conduct*, which falls under the governance dimension. Without exception, companies from all sectors assign high materiality for this category. In the regression analysis this was only the case for two sectors, consumer discretionary and industrials.

5.3 Final financial materiality compass – overlaying the integrated compass with experts' insights

Table 11 presents the results of the integrated FMC. This compass includes both the results of the regression analysis and the results of the sustainability report analysis, where the materiality assessment of each cell is the weighted average of the first-step FMC (weight of 2/3) and the second-step FMC (weight of 1/3). In this combined FMC, categories *E1 climate change, S1 own workforce* and *G1 business conduct* are rated as at least moderately material for all companies of all sectors.

Table 12 displays the results of the final financial materiality compass resulting from the ESG experts interviews. This final FMC not only considers the combined perspective of sustainability effects on financial performance data and of self-identified material sustainability categories, but it overlays this combined perspective with the viewpoints of ESG experts as a fine-tuning. As can be seen via comparison to Table 11, the experts' view leads to a strengthening in the assessment of financial materiality for all sustainability categories. Maybe unsurprisingly this affects the categories of *E1 climate change* and *S1 own workforce* most strongly, where three additional sectors show a strong materiality as compared to the combined FMC of Table 11. In total, we find categories

E1 climate change, S1 own workforce and *G1 business conduct* to be either weakly or strongly material for all sectors considered.

With regard to sectors, we observe the largest number of strongly material sustainability categories in the consumer discretionary sector where four ESRS categories turn out to be strongly material. This is followed by consumer staples, industrials and utilities with three ESRS categories being strongly material each. While all these sectors display *E1 climate change* among the strongly material ESRS categories and all but one also refer to *G1 business conduct*, the other strongly material categories fluctuate among sectors. At the same time, however, this result can also be interpreted as even the heavily discussed sustainability topics of *E1 climate change* and *S1 own workforce* not to be strongly material for most sectors. Moreover, ESRS categories *E2 pollution, E3 water and marine resources, E5 circular economy,* and *S4 consumers and end users* exhibit only weak financial materiality if at all. Stated differently, none of these topics shows strong financial materiality in any of the sectors. The lowest financial material impact appears for topics *E3 water and marine resources* and *S3 affected communities*. They display only weak financial materiality in four of the eleven sectors.

The results of the final FMC thus clearly show the differences in the financial materiality of ESRS sustainability categories across the various sectors. While a comparatively large number of sustainability categories display some financial materiality across the sectors considered (75 instances), only few of these (18, i.e. about a quarter) show a strong financially material impact. If firms were to report only on the strongly material sustainability categories, this would hence significantly limit their reporting needs. Particularly for resource-constrained firms, this allows them to focus much more strongly on those areas that are truly relevant to them.

6. Discussion

Our results are in line with the final changes made to the ESRS drafts by the EU Commission. In contrast to an initial draft, where the application of *E1 climate change* was suggested as mandatory for all companies and of *S1 own workforce* for companies with more than 250 employees (EFRAG 2022), the final revision submits all categories to a materiality analysis. However, companies have to justify why *E1 climate change* is not material for them (European Commission 2023b). The topic of climate change hence still receives a specific treatment in the final ESRS draft, following the outstanding importance that this sustainability topic has for transforming our economy.

Against the backdrop of the general relevance of these specific sustainability categories for our societies and life on earth, it is only fitting that our final FMC shows that the topics *E1 climate change* and *S1 own workforce* exhibit at least weak financial materiality in all sectors. Still, strong financial materiality even for these important

areas is obtained in only five, respectively four of the 11 different sectors. We therefore conclude that despite their general relevance and the huge societal attention that these topics receive, they are not equally relevant for all sectors and do not have strong financial materiality in all sectors. At the same time, the fact that only few ESRS categories appear strongly financial material for firms in various sectors indicates that a reasonable sustainability strategy – and the corresponding reporting needs – should be highly focused on the few topics that are indeed relevant. Our FMC gives firms a science-based indication with regard to the areas on which to direct this focus. We hope this result to be welcome particularly for resource-constrained firms.

We are aware of the fact that our FMC is limited in its applicability as it covers only 11 broad sectors. Indeed, we deliberately refrained from further subdivision of the sector classification system in order to uphold the number of observations, i.e. firms, per sector so that estimation errors in our statistical analyses can be minimized. Drawing reliable and valid conclusions from a much smaller number of companies per subsector would have been virtually impossible. This methodological decision comes at the cost, however, that there may be significant differences among the companies within one sector in terms of business model and corresponding risk-return profile. As a consequence, our FMC should be seen as a mere starting point for a more elaborate and individually-tailored materiality assessment.

Another challenge in our analysis pertains to the use of sustainability data from only one rating provider in our regression analysis. For instance, Berg et al. (2022) find a correlation of only 0.55 in their study when comparing general ESG data from four major sustainability rating providers. We leave the inclusion of additional sustainability data from further data providers into the analysis for future research. By combining the regression analysis with further information from self-identified materiality topics and expert views, we believe that our assessment takes into account many different and hopefully robust perspectives to make up for the potential ESG rating weakness.

7. Conclusion

We examine the financial materiality of sustainability topics in relation to the ESRS thematic categories for 11 distinct sectors in order to compile a Financial Materiality Compass. Our final FMC is based on three analytical steps: panel data regression, manual analysis of sustainability reports, and financial ESG expert interviews. Based on the combination of these broad and differentiated approaches, our final FMC indicates that not all ESRS categories are financial material for all sectors. Rather, only very few categories show a strong financial materiality in many sectors. Among them are *E1 climate change, S1 own workforce,* and *G1 business conduct.* Even these categories, however, are strongly financial material only in four, respectively five of the 11 different sectors that we

consider. Our FMC hence presents firms with a quite distinct basis to focus their resources when preparing their sustainability reports according to the CSRD.

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Tables

Table 1: Firm distribution by country of incorporation – first sample
This table shows the firm distribution in the first sample with respect to the country of incorporation.

All firms		
Country	N	%
Austria	36	1,88%
Belgium	52	2,72%
Bulgaria	1	0,05%
Cyprus	13	0,68%
Czech Republic	3	0,16%
Denmark	67	3,50%
Faroe Islands	2	0,10%
Finland	81	4,23%
France	191	9,98%
Germany	282	14,73%
Gibraltar	1	0,05%
Greece	31	1,62%
Guernsey	14	0,73%
Hungary	6	0,31%
Iceland	10	0,52%
Ireland; Republic of	51	2,66%
Isle of Man	3	0,16%
Italy	135	7,05%
Jersey	7	0,37%
Liechtenstein	2	0,10%
Luxembourg	37	1,93%
Malta	7	0,37%
Monaco	4	0,21%
Netherlands	76	3,97%
Norway	82	4,28%
Poland	40	2,09%
Portugal	16	0,84%
Romania	7	0,37%
Russia	46	2,40%
Slovak Republic	1	0,05%
Slovenia	3	0,16%
Spain	74	3,87%
Sweden	327	17,08%
Switzerland	204	10,66%
Ukraine	2	0,10%
Total	**1914**	**100,00%**

Table 2: Firm distribution by GICS® sectors – first sample
This table presents the firm distribution in the first sample with regard to GICS® sectors.

Sector	N	%
Communication Services	113	5,90%
Consumer Discretionary	209	10,92%
Consumer Staples	99	5,17%
Energy	65	3,40%
Financials	224	11,70%
Health Care	218	11,39%
Industrials	442	23,09%
Information Technologies	215	11,23%
Materials	149	7,78%
Real Estate	114	5,96%
Utilities	66	3,45%
Total	**1914**	**100,00%**

Table 3: Firm distribution by index – second sample
This table presents the firm distribution per capital market index constituency of the 294 firms analyzed in the second sample.

Country	Index	N
Belgium	BEL 20	13
France	CAC 40	39
	CAC Mid 60	51
Germany	DAX	38
	MDAX	47
	SDAX	19
Italy	FTSE MIB	24
Netherlands	AEX	22
Portugal	PSI	11
Spain	IBEX 35	30
Total		**294**

Table 4: Firm distribution by GICS® sectors – second sample
This table presents the firm distribution in the second sample with regard to GICS® sectors.

Sector	**N**
Communication Services	26
Consumer Discretionary	34
Consumer Staples	19
Energy	8
Financials	38
Health Care	22
Industrials	58
Information Technologies	26
Materials	26
Real Estate	15
Utilities	22
∑	**294**

Table 5: Number of published Refinitiv category scores per year – first sample
This table displays the number of category scores published by Refinitiv per year from 2010 to 2021.

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Emission	561	583	594	610	634	678	701	807	1,222	1,389	1,829	1,463
RUse	561	583	594	610	634	678	701	807	1,222	1,389	1,829	1,463
EInnovation	560	582	593	609	633	677	700	806	1,221	1,388	1,828	1,463
Comm	561	583	594	610	634	678	701	807	1,222	1,389	1,829	1,463
HR	561	583	594	610	634	678	701	807	1,222	1,389	1,829	1,463
PRes	561	583	594	610	634	678	701	807	1,222	1,389	1,829	1,463
WForce	561	583	594	610	634	678	701	807	1,222	1,389	1,829	1,463
CSRStrat	561	583	594	610	634	678	701	807	1,222	1,389	1,832	1,463
SH	561	583	594	610	634	678	701	807	1,222	1,389	1,832	1,463
Mgt	561	583	594	610	634	678	701	807	1,222	1,389	1,832	1,463

Table 6: Assignment of category scores to thematic areas according to ESRS – first sample
This table presents the mapping of Refinitiv category scores to topic areas based on the ESRS categories. This mapping is based on the content descriptions of the respective scores and categories. The *innovation* and *shareholder* category scores of Refinitiv are not assigned to any ESRS category. This is because of the limited content similarity between the scores and the ESRS standards.

ESRS category	**Refinitiv category score**
Climate change	Emission
Pollution	Emission
Water and marine resources	Resource use
Biodiversity and ecosystems	Emission
Resource use and circular economy	Resource use
Own workforce	Workforce
Workers in the value chain	Human rights
Affected Communities	Community
Consumers and end-users	Product Responsibility
Business conduct	CSR Strategy + Management

Table 7: Descriptive statistics - first sample
This table presents the descriptive statistics for all firms in the first sample, where Panel A refers to the dependent variables, Panel B to the explanatory variables, and Panel C to the control variables in the regressions. Detailed explanations of these variables' constructions are presented in Table A.1 in Online Appendix A.

All sectors	Firm-year obs.	Mean	Median	SD	Min	Max
Panel A: Dependent variables						
ROA	20,964	0.018	0.035	0.134	-0.742	0.284
ROE	20,486	0.072	0.098	0.287	-1.489	0.966
ROS	18,125	0.217	0.258	0.952	-6.324	3.797
TobinsQ	19,271	1.304	0.691	1.898	0.016	12.359
PE	15,404	28.376	17.234	43.905	1.908	337.592
DYield	14,714	0.040	0.025	0.061	0.000	0.459
Vol	18,419	0.022	0.020	0.011	0.008	0.067
VaR	18,473	0.033	0.030	0.014	0.012	0.086
CVaR	18,420	0.050	0.044	0.023	0.018	0.141
Panel B: Explanatory variables						
Emission	11,071	0.542	0.594	0.319	0.000	0.999
RUse	11,071	0.542	0.589	0.325	0.000	0.999
EInnovation	11,060	0.338	0.267	0.333	0.000	0.999
Comm	11,071	0.516	0.531	0.307	0.000	0.999
HR	11,071	0.463	0.508	0.357	0.000	0.995
PRes	11,071	0.541	0.574	0.318	0.000	0.999
WForce	11,071	0.670	0.733	0.261	0.001	0.999
CSRStrat	11,074	0.444	0.444	0.315	0.000	0.998
SH	11,074	0.518	0.520	0.282	0.001	0.999
Mgt	11,074	0.523	0.529	0.282	0.003	0.999
Panel C: Control variables						
MTB	19,136	3.283	1.777	5.305	-2.759	40.109
DARatio	20,874	0.585	0.583	0.261	0.028	1.620
Emp	9,990	13,989.650	2,551	33,991.760	9	220,345
ln_Sales	20,745	20.264	20.360	2.313	12.611	25.034

Table 8: Number of significances

This table presents the count of significances of the category scores' coefficients in each of the 9 regression equations per sector. * indicates significances at the 10% level. ** indicates significances at the 5% level. *** indicates significances at the 1% level. ∑ represents the sum of all significances of a category score in the 9 regressions and the sum of the count of the different significance levels. Panels A - K refer to the individual regressions for each of the 11 different sectors.

	*	**	***	∑
Panel A: Communication Services				
Emission	0	0	0	0
RUse	0	0	0	0
EInnovation	0	0	0	0
Comm	0	0	0	0
HR	1	2	0	3
PRes	0	2	0	2
WForce	0	0	0	0
CSRStrat	1	0	0	1
SH	2	1	0	3
Mgt	0	0	4	4
∑	4	5	4	**13**
Panel B: Consumer Discretionary				
Emission	1	3	0	4
RUse	1	1	0	2
EInnovation	1	0	0	1
Comm	1	0	1	2
HR	0	3	0	3
PRes	0	0	0	0
WForce	1	1	1	3
CSRStrat	0	3	0	3
SH	2	1	0	3
Mgt	2	3	1	6
∑	9	15	3	**27**
Panel C: Consumer Staples				
Emission	0	2	0	2
RUse	0	1	0	1
EInnovation	1	3	0	4
Comm	1	1	0	2
HR	2	2	0	4
PRes	0	1	0	1
WForce	0	1	0	1
CSRStrat	0	0	1	1
SH	1	1	1	3
Mgt	1	0	0	1
∑	6	12	2	**20**
Panel D: Energy				
Emission	1	0	0	1
RUse	2	0	0	2
EInnovation	0	1	0	1
Comm	0	0	0	0

HR	1	1	0	2
PRes	0	0	0	0
WForce	0	0	0	0
CSRStrat	0	0	0	0
SH	1	0	0	1
Mgt	0	0	0	0
∑	5	2	0	**7**
Panel E: Financials				
Emission	0	0	0	0
RUse	1	1	0	2
EInnovation	1	1	1	3
Comm	0	0	0	0
HR	0	1	0	1
PRes	0	0	0	0
WForce	1	1	1	3
CSRStrat	1	1	0	2
SH	0	0	0	0
Mgt	0	1	1	2
∑	4	6	3	**13**
Panel F: Health Care				
Emission	0	2	0	2
RUse	0	0	1	1
EInnovation	0	0	0	0
Comm	1	0	0	1
HR	0	0	1	1
PRes	0	0	0	0
WForce	0	0	0	0
CSRStrat	0	1	1	2
SH	0	0	0	0
Mgt	0	0	0	0
∑	1	3	3	**7**
Panel G: Industrials				
Emission	1	1	2	4
RUse	0	0	0	0
EInnovation	1	2	1	4
Comm	1	3	1	5
HR	0	3	0	3
PRes	0	0	0	0
WForce	1	0	0	1
CSRStrat	1	2	1	4
SH	0	1	0	1
Mgt	0	2	2	4
∑	5	14	7	**26**
Panel H: Information Technologies				
Emission	0	0	0	0
RUse	1	0	0	1
EInnovation	1	1	0	2
Comm	0	0	0	0

HR	1	0	0	1
PRes	1	0	0	1
WForce	0	1	2	3
CSRStrat	1	1	0	2
SH	0	1	3	4
Mgt	0	0	0	0
∑	5	4	5	**14**
Panel I: Materials				
Emission	0	0	0	0
RUse	0	0	0	0
EInnovation	2	0	0	2
Comm	0	2	0	2
HR	3	0	0	3
PRes	0	0	0	0
WForce	0	1	0	1
CSRStrat	0	0	0	0
SH	3	0	0	3
Mgt	1	1	1	3
∑	9	4	1	**14**
Panel J: Real Estate				
Emission	1	0	0	1
RUse	0	1	0	1
EInnovation	0	2	1	3
Comm	0	1	0	1
HR	0	0	0	0
PRes	1	1	1	3
WForce	0	1	0	1
CSRStrat	0	1	4	5
SH	1	1	0	2
Mgt	0	0	1	1
∑	3	8	7	**18**
Panel K: Utilities				
Emission	0	0	0	0
RUse	0	0	0	0
EInnovation	0	0	0	0
Comm	0	0	3	3
HR	0	2	0	2
PRes	1	1	1	3
WForce	0	1	3	4
CSRStrat	3	1	0	4
SH	0	1	2	3
Mgt	0	0	0	0
∑	4	6	9	**19**

Table 9: Financial materiality compass based on the regression analysis
This table presents the financial materiality compass based on the regression analysis of the first sample. The table illustrates the materiality intensity of the 10 different ESRS topics for companies in specific sectors. A value of 0 indicates no materiality, 1 indicates weak materiality, and 2 indicates high materiality.

Sector	E1	E2	E3	E4	E5	S1	S2	S3	S4	G1
Communication Services	0	0	0	0	0	0	1	0	0	1
Consumer Discretionary	2	2	0	2	0	1	1	0	0	2
Consumer Staples	0	0	0	0	0	0	2	0	0	0
Energy	0	0	0	0	0	0	0	0	0	0
Financials	0	0	0	0	0	1	0	0	0	0
Health Care	0	0	0	0	0	0	0	0	0	0
Industrials	2	2	0	2	0	0	1	2	0	2
Information Technologies	0	0	0	0	0	1	0	0	0	0
Materials	0	0	0	0	0	0	1	0	0	0
Real Estate	0	0	0	0	0	0	0	0	1	1
Utilities	0	0	0	0	0	2	0	1	1	0

Table 10: Financial materiality compass based on the sustainability report analysis
This table presents the financial materiality compass based on the analysis of sustainability reports of the second sample. The table illustrates the materiality intensity of the 10 different ESRS topics for companies in specific sectors. A value of 0 indicates no materiality, 1 indicates weak materiality, and 2 indicates high materiality.

Sector	E1	E2	E3	E4	E5	S1	S2	S3	S4	G1
Communication Services	2	0	0	0	1	2	1	1	2	2
Consumer Discretionary	2	0	0	1	1	2	2	1	2	2
Consumer Staples	2	0	1	1	2	2	2	1	2	2
Energy	2	1	1	0	1	2	2	1	1	2
Financials	2	0	0	0	0	2	1	1	1	2
Health Care	2	0	1	0	1	2	1	1	1	2
Industrials	2	0	0	0	1	2	1	1	1	2
Information Technologies	2	1	1	1	1	2	1	1	2	2
Materials	2	1	1	1	2	2	1	1	1	2
Real Estate	2	0	0	1	1	2	1	1	1	2
Utilities	2	0	0	1	1	2	1	1	1	2

Table 11: Combined financial materiality compass
This table presents the aggregated financial materiality compass of the regression analysis and the sustainability report analysis. The values from the regression analysis have been incorporated into this compass with a weighting of 2/3. The values from the sustainability report analysis have been incorporated with a weighting of 1/3. A value of 0 indicates no materiality, 1 indicates weak materiality, and 2 indicates high materiality.

Sector	E1	E2	E3	E4	E5	S1	S2	S3	S4	G1
Communication Services	1	0	0	0	0	1	1	0	1	1
Consumer Discretionary	2	1	0	2	0	1	1	0	1	2
Consumer Staples	1	0	0	0	1	1	2	0	1	1
Energy	1	0	0	0	0	1	1	0	0	1
Financials	1	0	0	0	0	1	0	0	0	1
Health Care	1	0	0	0	0	1	0	0	0	1
Industrials	2	1	0	1	0	1	1	2	0	2
Information Technologies	1	0	0	0	0	1	0	0	1	1
Materials	1	0	0	0	1	1	1	0	0	1
Real Estate	1	0	0	0	0	1	0	0	1	1
Utilities	1	0	0	0	0	2	0	1	1	1

Table 12: Final financial materiality compass
This table presents the final financial materiality compass. It comprises the results of the interviews with the seven financial ESG experts. A value of 0 indicates no materiality, 1 indicates weak materiality, and 2 indicates high materiality.

Sector	E1	E2	E3	E4	E5	S1	S2	S3	S4	G1
Communication Services	1	0	0	0	0	1	2	0	1	1
Consumer Discretionary	2	1	0	2	1	2	1	0	1	2
Consumer Staples	2	1	1	2	1	1	2	0	1	1
Energy	2	1	1	1	1	1	1	1	0	1
Financials	1	0	1	0	1	2	1	0	1	1
Health Care	1	0	0	1	0	1	0	0	1	1
Industrials	2	1	0	1	1	1	1	2	0	2
Information Technologies	1	0	0	0	1	2	0	0	1	1
Materials	1	1	0	1	1	1	1	1	0	1
Real Estate	1	0	0	0	0	1	0	0	1	2
Utilities	2	1	1	0	0	2	0	1	1	2

Online appendix A

Table A.1: Variables description – first and second sample
This table presents a detailed description of the variables used in the regression and sustainability report analysis. Panel A describes the dependent variables, Panel B describes the explanatory variables, Panel C describes the control variables and Panel D describes the sustainability report variables.

Panel A: Dependent variables	
Return on Assets (ROA)	ROA is an accounting-based indicator of a firm's profitability. It consists of net income divided by total assets. A higher value therefore stands for higher profitability.
Return on Equity (ROE)	ROE is an accounting-based indicator of a firm's profitability. It is composed of net income divided by shareholders' equity. A higher value thus stands for higher profitability.
Return on Sales (ROS)	ROS is an accounting-based indicator of firm's profitability. It indicates how much profit the company generates per euro of sales. It is composed of earnings before interest and taxes divided by net revenue. A higher value thus stands for higher profitability.
TobinsQ	TobinsQ is a market-based indicator of a firm's profitability. It indicates the ratio of the market value of a firm to its intrinsic value and is composed of the market value of a firm divided by its total assets. A value greater than 1 indicates an overvaluation of the firm and a value less than 1 indicates an undervaluation of the firm.
Price-Earnings Ratio (PE)	PE is a market-based indicator of a firm's profitability. It is composed of the firm's market value per share divided by the firm's earnings per share. It gives an indication of whether a firm may be overvalued. If the value is high, the share price is relatively high compared to the firm's earnings and therefore possibly overvalued. A low PE in turn indicates that the share is rather cheap to buy.
Dividend Yield (DYield)	DYield is a market-based indicator of a firm's profitability. It indicates the percentage of a firm's share price that a company pays out in dividends each year. It is composed of annual dividend payments per share divided by enterprise value per share.
Volatility (Vol)	Vol is a measure of a firm's equity risk. It is calculated by means of the standard deviation of daily returns within one year.
Value at Risk (VaR)	VaR is a measure of a firms' equity risk. It is calculated on the 5% confidence interval of daily stock price returns in one year. This consequently results in a negative value. For ease of interpretation, this is multiplied by -1 and thus converted into a positive value. Thus, a lower value indicates a lower equity risk.
Conditional Value at Risk (CVaR)	CVaR is a measure of a firm's equity risk. It is the average of all daily share price returns that are below the VaR at the 5% level. This results in a negative value. For ease of interpretation, this is also multiplied by -1 and thus converted into a positive value. Thus, a lower value indicates a lower equity risk.

Panel B: Explanatory variables	
Emission Reduction Score (Emission)	"The emission reduction score measures a company's commitment and effectiveness towards reducing environmental emissions in its production and operational processes" (Refinitiv, 2022). This score can take values between 0 and 100. For reasons of interpretation, we transformed the score in our analysis so that it takes on values between 0 and 1.
Resource Use Score (RUse)	"The resource use score reflects a company's performance and capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management" (Refinitiv, 2022). This score can take values between 0 and 100. For reasons of interpretation, we transformed the score in our analysis so that it takes on values between 0 and 1.
Innovation Score (EInnovation)	"The innovation score reflects a company's capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through new environmental technologies and processes, or eco-designed products" (Refinitiv, 2022). This score can take values between 0 and 100. For reasons of interpretation, we transformed the score in our analysis so that it takes on values between 0 and 1.
Community Score (Comm)	"The community score measures the company's commitment to being a good citizen, protecting public health and respecting business ethics" (Refinitiv, 2022). This score can take values between 0 and 100. For reasons of interpretation, we transformed the score in our analysis so that it takes on values between 0 and 1.
Human Rights Score (HR)	"The human rights score measures a company's effectiveness in terms of respecting fundamental human rights conventions" (Refinitiv, 2022). This score can take values between 0 and 100. For reasons of interpretation, we transformed the score in our analysis so that it takes on values between 0 and 1.
Product Responsibility Score (PRes)	"The product responsibility score reflects a company's capacity to produce quality goods and services, integrating the customer's health and safety, integrity and data privacy" (Refinitiv, 2022). This score can take values between 0 and 100. For reasons of interpretation, we transformed the score in our analysis so that it takes on values between 0 and 1.
Workforce Score (WForce)	"The workforce score measures a company's effectiveness in terms of providing job satisfaction, a healthy and safe workplace, maintaining diversity and equal opportunities, and development opportunities for its workforce" (Refinitiv, 2022). This score can take values between 0 and 100. For reasons of interpretation, we transformed the score in our analysis so that it takes on values between 0 and 1.
CSR Strategy Score (CSRStrat)	"The CSR strategy score reflects a company's practices to communicate that it integrates economic (financial), social and environmental dimensions into its day-to-day decision-making processes" (Refinitiv, 2022). This score can take values between 0 and 100. For reasons of interpretation, we transformed the score in our analysis so that it takes on values between 0 and 1.

Shareholders Score (SH)	"The shareholders score measures a company's effectiveness towards equal treatment of shareholders and the use of anti-takeover devices" (Refinitiv, 2022). This score can take values between 0 and 100. For reasons of interpretation, we transformed the score in our analysis so that it takes on values between 0 and 1.
Management Score (Mgt)	"The management score measures a company's commitment and effectiveness towards following best practice corporate governance principles" (Refinitiv, 2022). This score can take values between 0 and 100. For reasons of interpretation, we transformed the score in our analysis so that it takes on values between 0 and 1.
Panel C: Control variables	
Natural Logarithm of Sales (ln_Sales)	The ln_Sales serves as a proxy for the firm size. It is calculated from the natural logarithm of sales.
Market-to-Book Ratio (MTB)	MTB serves as a proxy for a firm's growth opportunities. It is calculated from the market value of equity divided by the book value of equity.
Debt-to-Asset Ratio (DARatio)	The DARatio serves as a proxy for the capital structure of a firm. It is calculated by dividing the total liabilities by the total assets of a company.
Employees (Emp)	The Emp serve as a proxy for the size of a firm. For this variable, the annual average number of employees was used. The natural logarithm was not used here.
Panel D: Sustainability report variables	
ESRS E1 Climate change	Variable E1 climate change covers the various topics of the ESRS E1 standard climate change. It includes the topics of climate change adaptation; climate change mitigation as well as energy (European Commission, 2023b). This variable can take the values 0, 1 or 2. This depends on the respective materiality assessment of this topic by the company itself.
ESRS E2 Pollution	Variable E2 pollution covers the various topics of the ESRS E2 standard pollution. It includes the topics of pollution of air; pollution of water; pollution of soil; pollution of living organisms and food resources; substances of concern; substances of very high concern as well as micro plastics (European Commission, 2023b). This variable can take the values 0, 1 or 2. This depends on the respective materiality assessment of this topic by the company itself.
ESRS E3 Water and marine resources	Variable E3 water and marine resources covers the various topics of the ESRS E3 standard water and marine resources. It includes the topics of water and marine resources (European Commission, 2023b). This variable can take the values 0, 1 or 2. This depends on the respective materiality assessment of this topic by the company itself.

ESRS E4 Biodiversity and ecosystems	Variable E4 biodiversity and ecosystems covers the various topics of the ESRS E4 standard biodiversity and ecosystems. It includes the topics of direct impact drivers of biodiversity loss; impacts on the state of species; impacts on the extent and condition of ecosystems as well as impacts and dependencies on ecosystem services (European Commission, 2023b). This variable can take the values 0, 1 or 2. This depends on the respective materiality assessment of this topic by the company itself.
ESRS E5 Resource use and circular economy	The variable E5 resource use and circular economy covers the various topics of the ESRS E5 standard resource use and circular economy. It includes the topics resources inflows, including resource use; resource outflows related to products and services as well as waste (European Commission, 2023b). This variable can take the values 0, 1 or 2. This depends on the respective materiality assessment of this topic by the company itself.
ESRS S1 Own workforce	The variable S1 own workforce covers the various topics of the ESRS S1 standard own workforce. It includes the topics of working conditions; equal treatment and opportunities for all as well as other work-related rights (European Commission, 2023b). This variable can take the values 0, 1 or 2. This depends on the respective materiality assessment of this topic by the company itself.
ESRS S2 Workers in the value chain	The variable S2 workers in the value chain encompasses the various topics of the ESRS S2 standard workers in the value chain. It includes the topics of working conditions; equal treatment and opportunities for all as well as other work-related rights (European Commission, 2023b). This variable can take the values 0, 1 or 2. This depends on the respective materiality assessment of this topic by the company itself.
ESRS S3 Affected communities	The variable S3 affected communities includes the various topics of the ESRS S3 standard affected communities. It includes the topics of communities' economic, social and cultural rights; communities' civil and political rights as well as rights of indigenous peoples (European Commission, 2023b). This variable can take the values 0, 1 or 2. This depends on the respective materiality assessment of this topic by the company itself.
ESRS S4 Consumers and end-users	The variable S4 consumers and end-users covers the various topics of the ESRS S4 standard consumers and end-users. It includes the topics information-related impacts for consumers and/or end-users, personal safety of consumers and/or end-users as well as social inclusion of consumers and/or end-users (European Commission, 2023b). This variable can take the values 0, 1 or 2. This depends on the respective materiality assessment of this topic by the company itself.
ESRS G1 Business conduct	The variable G1 business conduct covers the various topics of the ESRS G1 standard business conduct. It includes the topics of corporate culture; protection of whistle-blowers; animal welfare; political engagement and lobbying activities; management of relationships with suppliers including payment practices as well as corruption and bribery (European Commission, 2023b). This variable can take the values 0, 1 or 2. This depends on the respective materiality assessment of this topic by the company itself.

Table A.2 Detailed sustainability report analysis variables description – second sample
This table presents the allocation of the topics classified as material by the companies in their sustainability reports to the ESRS categories. The topics of the respective standards specified in the ESRS are also shown. We used these as a basis for assigning the most material topics to each category. This table does not contain the full list of variables and is presented for illustrative purposes only.

ESRS Category	Topics named by ESRS	Topics named by the companies
E1 Climate Change	• **Climate change adaption** • **Climate change mitigation** • **Energy**	*Carbon emissions *Climate and Energy *Climate change adaptation *Climate change mitigation *Climate neutrality *Climate protection *Climate risk *Combating climate change *CO2 emissions *CO2 emissions in power plants *CO2 footprint *CO2 reductions *Decarbonization *Electromobility *Emission-free mobility *Emission-free mobility and industries *Emissions *Emissions and air quality *Energy consumption *Energy consumption and mix *Energy efficiency and climate change *Energy efficiency in production *Energy-efficient products *Energy management and emissions *Energy projects *Energy use and CO2 emissions *ESG in the insurance business *EU-Taxonomy *Expansion of renewable energies *Greenhouse gas emissions *More sustainable materials and circular economy processes *Natural disasters *New technical developments *Physical effects of climate change *Procurement of components for renewable energies *Renewable energies *Scopes 1, 2, 3 *Sustainability effects in lending *Sustainable Finance *Sustainable investment and capital market products *Sustainable Protection *Transportation and logistics

E2 Pollution	• **Pollution of air** • **Pollution of water** • **Pollution of soil** • **Pollution of living organisms and food resources** • **Substances of concern** • **Substances of very high concern** • **Micro plastics**	*Air and soil emissions *Air quality water and waste *Emissions and air quality *NOX, dust and mercury emissions from power plants *Plant, process and transport safety *Plastic waste *Pollution *Pollution prevention *Preservation of air, water and soil quality *Safe handling of chemicals *Waste diversion

E3 Water and marine resources	• **Water**
	• **Marine resources**
	  • Water consumption
	  • Water withdrawals
	  • Water discharges
	  • Water discharges in the oceans
	  • Extraction and use of marine resources
		*Biodegradability
		*Conserving resources with water
		*Protection of water resources
		*Safe and sustainable locations
		*Waste water and waste water disposal
		*Water
		*Water consumption in production
		*Water consumption in supply chain
		*Water footprint / scarcity
		*Water management
		*Water protection
		*Water use and extraction

E4 Biodiversity and ecosystems	• **Direct impact drivers of biodiversity loss**
	  • Climate Change
	  • Land-use change, fresh water-use change and sea use change
	  • Direct exploitation
	  • Invasive alien species
	  • Pollution
	  • Others
	• **Impacts on the state of species**
	  • e.g. Species population size
	  • e.g. Species global extinction risk
	• **Impacts on the extent and condition of ecosystems**
	  • e.g. Land degradation
	  • e.g. Desertification
	  • e.g. Soil sealing
	• **Impacts and dependencies on ecosystem services**
		*Biodiversity
		*Biodiversity and ecosystem
		*Deforestation and land use
		*Environmental protection and biodiversity
		*Impact of renewable energies on areas with high biodiversity value
		*Land use
		*Promotion of biodiversity
		*Protection of biodiversity diversity and natural areas
		*Quality of recultivation
		*Renewable raw materials
		*Reutilization of the areas used of the land use
		*Sustainable palm kernel oil

E5 Circular economy	• **Resources inflows, including resource use** • **Resource outflows related to products and services** • **Waste**	*Alternative sources of raw materials *Circular and sustainable procurement *Circular economy *Dealing with waste *Efficient and responsible use of input materials in production *Food waste *More sustainable materials and circular economy processes *More sustainable materials and circular services *Packaging and product waste *Packaging and waste *Product sustainability *Raw material and material consumption *Raw material consumption *Recyclability and end-of-life solutions life cycle *Recycling / reuse *Renewable energies *Resource efficiency and waste *Strengthening the circular economy *Sustainable land use *Sustainable packaging solutions *Waste *Waste and recycling *Waste and recycling management *Waste materials from production *Waste prevention in the supply chain

S1 Own workforce	• **Working conditions**
	  • Secure employment
	  • Working time
	  • Adequate wages
	  • Social dialogue
	  • Freedom of association, the existence of works councils and the information, consultation and participation of workers
	  • Collective bargaining, including rate of workers covered by collective agreements
	  • Work-life balance
	  • Health and safety
	• **Equal treatment and opportunities for all**
	  • Gender equality and equal pay for work of equal value
	  • Training and skills development
	  • Employment and inclusion of persons with disabilities
	  • Measures against violence and harassment in the workplace
	  • Diversity
	• **Other work-related rights**
	  • Child labor
	  • Forced labor
	  • Adequate housing
	  • Privacy
		*Access to healthcare
		*Accidents at work
		*Attractiveness as an employer
		*Clean and safe factories
		*Commitment and motivation of employees
		*Development of the workforce
		*Diversity, employment, health
		*Diversity, equality and inclusion
		*Education and training
		*Employee commitment
		*Employee/employer relationship
		*Employee experience and engagement
		*Employee satisfaction
		*Employees' rights
		*Employer attractiveness and employee development
		*Fair and appropriate remuneration
		*Fair remuneration
		*Fair working conditions
		*Feedback culture
		*Freedom of association
		*Flexibility in the workplace and sustainable working conditions
		*Further training
		*Future of work
		*Good working conditions
		*Health and performance
		*Human resources strategy
		*Human rights
		*Human rights and labor and social standards
		*Hygiene
		*Innovation and digitalization
		*Learning and development
		*Management development
		*Non-discrimination and diversity
		*Occupational health and safety
		*Personnel development

		*Prevention of discrimination *Process and plant safety *Promoting diversity and gender equality of the sexes *Proportion of women in the workforce and management *Recruitment *Recruitment and employee participation *Remuneration *Responsibility as an employer *Responsibility for employees *Retention *Safe operation of power plants and opencast mines *Working conditions *Work-life balance

S2 Workers in the value chain	• **Working conditions**
	  • Secure employment
	  • Working time
	  • Adequate wages
	  • Social dialogue
	  • Freedom of association, the existence of works councils
	  • Collective bargaining
	  • Work-life balance
	  • Health and safety
	• **Equal treatment and opportunities for all**
	  • Gender equality and equal pay for work of equal value
	  • Training and skills development
	  • Employment and inclusion of persons with disabilities
	  • Measures against violence and harassment in the workplace
	  • Diversity
	• **Other work-related rights**
	  • Child labor
	  • Forced labor
	  • Adequate housing
	  • Water and sanitation
	  • Privacy
		*Ethical trade and fair conditions in the workplace
		*Fair working conditions
		*Human rights
		*Human rights and labor rights
		*Human rights due diligence
		*Human rights with a focus on social standards in the supply chain
		*International principles and values
		*Purchasing and supplier network
		*Respect for human rights, child labor and forced labor
		*Respect for human rights in the supply chain
		*Responsible value chain
		*Safety of employees at partner companies
		*Social standards in the supply chain
		*Supplier relations
		*Supply chain
		*Supply chain and human rights due diligence

S4 Consumers and end-users	• **Information-related impacts for consumers and/or end-users**
	  • Privacy
	  • Freedom of expression
	  • Access to (quality) information
	• **Personal safety of consumers and/or end-users**
	  • Health and safety
	  • Security of a person
	  • Protection of children
	• **Social inclusion of consumers and/or end-users**
	  • Non-discrimination
	  • Access to products and services
	  • Responsible marketing practices
		*Access and inclusion
		*Access to healthcare and medicine
		*Alternative test methods
		*Benchmark for quality
		*Children and youth protection
		*Customer health and safety
		*Customer orientation and customer service
		*Customers
		*Customer satisfaction
		*Data protection
		*Data protection and confidentiality
		*Data security
		*Dialog
		*Energy and energy-related markets
		*ESG integration into products
		*Eurex ESG derivatives
		*Food safety & quality
		*Improving access to care
		*Inclusive business
		*Innovation, digitalization and customer orientation
		*Membership
		*Patient and product safety
		*Patient safety
		*Personalized healthcare
		*Product design
		*Product information
		*Product quality and safety
		*Product-related crime
		*Product safety and integrity
		*Product stewardship
		*Product transparency
		*Reporting
		*Research and development
		*Safe mobility
		*Safety of chemical products
		*Safety/product responsibility
		*SDG-compliant product portfolio
		*Security concepts for events
		*Sustainable index products
		*Sustainable product portfolio
		*Sustainable product range
		*Sustainable R&D-based innovation portfolio
		*Technology and innovation
		*Transformation for prevention
		*Transparency and fairness in customer relationships

G1 Business conduct	• **Corporate culture**
	• **Protection of whistle-blowers**
	• **Animal welfare**
	• **Political engagement and lobbying activities**
	• **Management of relationships with suppliers including payment practices**
	• **Corruption and bribery**
	  • Prevention and detection including training
	  • Incidents
		*Animal welfare
		*Analysis of compliance risks
		*Anti-corruption
		*Anti-discrimination
		*Anti-financial crime
		*Antitrust law
		*Approach to taxes
		*Avoidance of anti-competitive behavior
		*Bioethics
		*Business ethics
		*Children and youth protection
		*Code of conduct for business life
		*Competitiveness
		*Compliance
		*Compliance management
		*Compliance organization
		*Compliance rules and regulations
		*Compliance training
		*Compliance with laws, principles and guidelines
		*Control
		*Convenience
		*Corporate governance and compliance
		*Corruption and anti-competitive behavior
		*Clinical studies
		*Cybersecurity
		*Data protection
		*Digital ethics
		*Due diligence/review of customers etc.
		*Eco-efficiency
		*Economic result
		*Ensure the security of IT systems and data
		*ESG risks
		*Ethical business practices
		*Fair business behavior
		*Fair business practices
		*Implementation and monitoring of compliance with the code of conduct

		*Insider information *Integration of sustainability in governance structures *Integrity and compliance *Internal/external audit *Internationality *Investments *Leadership promise *Long-term value creation *Material Compliance *Norms and standards *Product efficiency *Product portfolio and longevity *Public policy and regulation *Quality *Reliability *Resilience of the business model *Risk management *Stakeholder dialog *Standards in the supply chain *Structural change *Sustainability in the supply chain *Sustainable management practice *Sustainable supply chain management *Systemic transition *Transparency on the content of lobbying activities *Whistleblower system

Table A.3: Panel regression results for the communication services sector

This table presents the dynamic panel estimation regarding the effects of sustainability category scores on the financial performance and equity risk of companies in the communication services sector. The coefficients are estimated in accordance with equation (1) using the one-step system GMM estimator introduced by Arellano and Bond (1991) and Blundell and Bond (1998). The dependent variables are the accounting-based measures *ROA* in model (1), *ROE* in model (2), *ROS* in model (3), the market-based measures *TobinsQ* in model (4), *PE* in model (5), *DYield* in model (6), as well as the equity risk measures *Vol* in model (7), *VaR* in model (8), and *CVaR* in model (9). *Lag. Dep. Var.* refers to the lagged value of the respective dependent variable. *Obs.* indicates the number of firms in each model. Detailed descriptions of all variables are presented in Table A.1 in Online Appendix A. The standard errors are robust, and z-statistics are reported in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Communication Services									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	ROA	ROE	ROS	TobinsQ	PE	DYield	Vol	VaR	CVaR
Lag. Dep. Var.	0.100	0.204	0.693***	0.462***	-0.056**	0.412***	-0.092	-0.209**	-0.236**
	(0.505)	(0.920)	(3.565)	(4.655)	(-2.252)	(4.105)	(-0.658)	(-2.007)	(-2.474)
Emission	-0.038	-0.077	-0.138	0.246	38.620	-0.030	0.003	0.004	0.007
	(-0.851)	(-0.651)	(-1.285)	(0.834)	(1.003)	(-1.004)	(0.549)	(0.653)	(0.645)
RUse	0.029	0.304	0.172	0.690	50.744	-0.039	0.000	0.004	-0.002
	(0.410)	(1.563)	(0.834)	(1.116)	(1.128)	(-1.032)	(0.045)	(0.438)	(-0.129)
EInnovation	0.033	-0.004	-0.073	-0.351	18.044	0.035	0.003	0.000	0.001
	(0.789)	(-0.041)	(-0.557)	(-1.308)	(0.299)	(0.747)	(0.357)	(0.014)	(0.192)
Comm	-0.028	-0.016	-0.051	-0.300	-45.502	-0.042	0.004	0.004	0.002
	(-0.922)	(-0.191)	(-0.335)	(-1.087)	(-1.081)	(-1.456)	(0.776)	(0.808)	(0.220)
HR	-0.024	0.116	-0.015	0.184	0.530	0.024	-0.007**	-0.010**	-0.012*
	(-0.906)	(1.070)	(-0.210)	(0.702)	(0.017)	(0.985)	(-2.072)	(-2.161)	(-1.887)
PRes	0.000	0.040	-0.177	-0.752*	-130.668*	-0.002	-0.004	-0.005	-0.012
	(0.014)	(0.311)	(-1.440)	(-1.877)	(-1.885)	(-0.059)	(-0.772)	(-0.788)	(-0.968)
WForce	0.090	0.141	0.103	-0.151	-0.013	0.074	-0.011	-0.006	-0.017
	(1.337)	(0.704)	(0.451)	(-0.368)	(-0.001)	(1.360)	(-1.583)	(-0.694)	(-0.899)
CSRStrat	-0.023	-0.076	-0.175*	0.039	12.427	0.043	0.002	-0.002	0.008
	(-0.524)	(-0.813)	(-1.721)	(0.181)	(0.355)	(1.276)	(0.619)	(-0.398)	(0.816)
SH	0.014	-0.010	-0.057	0.068	32.987	0.014	0.005*	0.006*	0.014**
	(0.551)	(-0.116)	(-0.679)	(0.365)	(1.413)	(0.996)	(1.808)	(1.694)	(2.189)
Mgt	-0.030	-0.068	0.067	-0.545***	-2.740	0.005	0.007***	0.007***	0.016***
	(-0.988)	(-0.950)	(0.657)	(-2.749)	(-0.113)	(0.274)	(3.187)	(2.630)	(2.969)
ln_Sales	0.048*	0.017	0.138**	-0.138	-30.267	0.026*	-0.008***	-0.012***	-0.021***
	(1.957)	(0.248)	(2.039)	(-0.568)	(-1.049)	(1.855)	(-3.901)	(-4.381)	(-4.113)
MTB	0.005	0.013	0.018	0.173***	3.106	-0.004*	-0.000	-0.001	-0.002*
	(1.257)	(1.628)	(1.243)	(4.472)	(1.056)	(-1.890)	(-0.217)	(-1.254)	(-1.738)
DARatio	-0.191**	-0.377	0.077	-1.145**	123.930***	0.023	-0.002	0.006	0.014
	(-2.106)	(-1.502)	(0.288)	(-2.060)	(2.899)	(0.472)	(-0.219)	(0.936)	(1.073)
Emp	-0.000	-0.000	-0.000	0.000	0.001	-0.000	0.000	0.000*	0.000
	(-0.823)	(-0.495)	(-1.325)	(0.403)	(1.051)	(-1.032)	(1.573)	(1.760)	(0.980)
Constant	-0.883*	-0.272	-2.695*	4.231	617.940	-0.560*	0.203***	0.287***	0.496***
	(-1.871)	(-0.202)	(-1.916)	(0.887)	(1.035)	(-1.934)	(4.489)	(4.709)	(4.901)
Firm-year Obs.	398	395	377	388	275	290	379	379	379
Obs.	79	78	76	75	59	57	73	73	73
No. of Instruments	80	80	80	80	80	80	80	80	80
Wald Chi2	47.500	16.680	130.870	262.090	196.180	188.290	61.840	52.300	108.730
Prob. > Chi2	0.000	0.339	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Robust z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.4: Panel regression results for the consumer discretionary sector

This table presents the dynamic panel estimation for the effects of sustainability category scores on the financial performance and equity risk of companies in the consumer discretionary sector. The coefficients are estimated in accordance with equation (1) using the one-step system

GMM estimator introduced by Arellano and Bond (1991) and Blundell and Bond (1998). The dependent variables are the accounting-based measures *ROA* in model (1), *ROE* in model (2), *ROS* in model (3), the market-based measures *TobinsQ* in model (4), *PE* in model (5), *DYield* in model (6), as well as the equity risk measures *Vol* in model (7), *VaR* in model (8), and *CVaR* in model (9). *Lag. Dep. Var.* refers to the lagged value of the respective dependent variable. *Obs.* indicates the number of firms in each model. Detailed descriptions of all variables are presented in Table A.1 in Online Appendix A. The standard errors are robust, and the z-statistics are reported in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Consumer Discretionary									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	ROA	ROE	ROS	TobinsQ	PE	DYield	Vol	VaR	CVaR
Lag. Dep. Var.	0.165***	-0.005	0.288**	0.124	-0.029	0.052	-0.430***	-0.404***	-0.544***
	(2.683)	(-0.033)	(2.383)	(1.489)	(-0.604)	(0.628)	(-8.285)	(-8.412)	(-10.907)
Emission	-0.075**	0.029	-0.128	-0.075	17.792	-0.034*	0.009**	0.011**	0.013
	(-2.211)	(0.214)	(-0.978)	(-0.172)	(0.776)	(-1.825)	(2.283)	(2.160)	(1.640)
RUse	0.045	0.022	0.032	0.806**	-8.213	-0.027	0.005	0.006	0.017*
	(1.450)	(0.197)	(0.199)	(2.189)	(-0.380)	(-1.552)	(1.147)	(0.869)	(1.724)
EInnovation	-0.003	0.118	0.126	-0.092	12.033	0.001	0.007*	0.005	0.011
	(-0.109)	(0.902)	(0.792)	(-0.510)	(0.792)	(0.106)	(1.791)	(1.004)	(1.371)
Comm	0.017	0.265***	-0.137	0.170	32.976	-0.026*	-0.002	0.002	-0.007
	(0.761)	(2.619)	(-0.960)	(0.605)	(1.594)	(-1.718)	(-0.771)	(0.380)	(-1.022)
HR	-0.053**	-0.217**	-0.249**	-0.467	8.549	0.012	-0.002	-0.004	-0.001
	(-2.335)	(-2.137)	(-2.132)	(-1.573)	(0.464)	(1.289)	(-0.608)	(-0.810)	(-0.142)
PRes	-0.020	-0.076	-0.190	-0.270	-11.325	0.003	0.003	0.002	0.013
	(-0.901)	(-0.831)	(-1.513)	(-1.189)	(-0.764)	(0.263)	(1.034)	(0.345)	(1.528)
WForce	0.047	0.027	0.331***	0.037	-17.236	0.006	-0.007	-0.013**	-0.022*
	(1.450)	(0.316)	(2.616)	(0.135)	(-0.877)	(0.381)	(-1.472)	(-2.139)	(-1.950)
CSRStrat	0.006	-0.177	-0.113	-0.606**	2.596	0.020	0.008**	0.006	0.019**
	(0.200)	(-1.149)	(-0.693)	(-2.353)	(0.146)	(1.393)	(2.032)	(1.113)	(2.067)
SH	-0.015	0.061	-0.050	0.098	6.314	-0.006	0.005*	0.006*	0.016**
	(-0.996)	(0.637)	(-0.782)	(0.637)	(0.865)	(-0.482)	(1.844)	(1.883)	(2.417)
Mgt	-0.052**	-0.156*	-0.044	-0.283	-5.655	-0.033***	0.007**	0.010**	0.011*
	(-2.544)	(-1.715)	(-0.309)	(-1.584)	(-0.624)	(-3.006)	(2.516)	(2.281)	(1.661)
ln_Sales	0.037***	0.141***	0.266***	-0.025	-19.218*	-0.006	-0.006***	-0.007***	-0.009**
	(2.610)	(2.766)	(2.928)	(-0.208)	(-1.829)	(-0.845)	(-4.261)	(-3.761)	(-2.516)
MTB	0.007***	0.011	-0.007	0.334***	0.868	-0.003***	-0.000*	-0.001**	-0.002***
	(3.125)	(1.056)	(-0.557)	(7.811)	(0.591)	(-3.718)	(-1.740)	(-2.507)	(-4.110)
DARatio	-0.103	-0.128	0.203	-2.514***	73.501	0.026	0.020***	0.025***	0.063***
	(-1.634)	(-0.498)	(0.815)	(-3.904)	(1.429)	(0.984)	(3.692)	(2.867)	(4.218)
Emp	-0.000	-0.000	-0.000**	0.000	0.000	0.000***	0.000	0.000	0.000
	(-1.056)	(-1.390)	(-2.464)	(0.280)	(1.138)	(3.547)	(0.704)	(1.147)	(0.216)
Constant	-0.643**	-2.736***	-5.329***	2.340	373.443*	0.176	0.135***	0.170***	0.202***
	(-2.270)	(-2.644)	(-2.838)	(0.871)	(1.829)	(1.341)	(4.593)	(4.328)	(2.881)
Firm-year Obs.	573	568	549	562	436	463	551	551	551
Obs.	149	149	142	144	118	116	139	139	139
No. of Instruments	80	80	80	80	80	80	80	80	80
Wald Chi2	114.630	41.100	81.630	406.980	24.920	94.650	147.880	193.990	273.510
Prob. > Chi2	0.000	0.000	0.000	0.000	0.051	0.000	0.000	0.000	0.000

Robust z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.5: Panel regression results for the consumer staples sector
This table presents the dynamic panel estimation for the effects of sustainability category scores on the financial performance and equity risk of companies in the consumer staples sector. The coefficients are estimated in accordance with equation (1) using the one-step system GMM estimator introduced by Arellano and Bond (1991) and Blundell and Bond (1998). The dependent variables are the accounting-based measures *ROA* in model (1), *ROE* in model (2), *ROS* in model (3), the market-based measures *TobinsQ* in model (4), *PE* in model (5), *DYield* in model

(6), as well as the equity risk measures *Vol* in model (7), *VaR* in model (8), and *CVaR* in model (9). *Lag. Dep. Var.* refers to the lagged value of the respective dependent variable. *Obs.* indicates the number of firms in each model. Detailed descriptions of all variables are presented in Table A.1 in Online Appendix A. The standard errors are robust, and the z-statistics are reported in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Consumer Staples									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	ROA	ROE	ROS	TobinsQ	PE	DYield	Vol	VaR	CVaR
Lag. Dep. Var.	0.277	-0.173**	0.390**	0.695***	0.110	0.538***	-0.044	-0.191**	-0.203***
	(1.581)	(-2.039)	(2.113)	(7.347)	(1.010)	(3.005)	(-0.375)	(-2.342)	(-2.891)
Emission	-0.029	0.231	-0.115	0.955**	12.147	-0.352	0.005	0.005	0.027**
	(-0.892)	(0.811)	(-1.300)	(2.449)	(0.873)	(-1.513)	(1.001)	(0.762)	(2.399)
RUse	0.007	-0.174	0.014	0.123	23.180*	0.106	-0.005	-0.001	0.003
	(0.193)	(-0.676)	(0.104)	(0.327)	(1.808)	(0.695)	(-0.915)	(-0.097)	(0.228)
EInnovation	-0.036**	-0.671**	-0.079*	-0.789**	7.916	-0.058	0.001	-0.002	-0.005
	(-2.140)	(-2.040)	(-1.690)	(-1.970)	(0.884)	(-0.838)	(0.279)	(-0.294)	(-0.476)
Comm	0.036*	-0.008	0.069	-0.424	-20.325**	0.035	-0.002	-0.003	-0.004
	(1.777)	(-0.047)	(1.596)	(-0.661)	(-1.999)	(0.283)	(-0.682)	(-0.708)	(-0.565)
HR	0.002	0.060	-0.109*	-0.403	-10.187	-0.085	0.009*	0.017**	0.024**
	(0.094)	(0.336)	(-1.667)	(-0.669)	(-1.216)	(-0.585)	(1.816)	(2.314)	(2.430)
PRes	-0.043	0.076	0.010	0.392	11.826	0.281**	0.000	-0.003	0.004
	(-1.514)	(0.417)	(0.131)	(1.423)	(0.854)	(2.224)	(0.096)	(-0.426)	(0.414)
WForce	0.001	-0.167	0.022	-0.264	-2.613	-0.333**	-0.001	0.000	-0.012
	(0.062)	(-0.826)	(0.346)	(-0.677)	(-0.210)	(-2.292)	(-0.195)	(0.030)	(-0.887)
CSRStrat	-0.010	-0.004	-0.066	-0.684***	11.851	-0.189	0.005	0.005	0.008
	(-0.488)	(-0.033)	(-0.956)	(-2.596)	(0.952)	(-0.922)	(1.522)	(1.259)	(1.004)
SH	0.010	-0.247*	-0.043	0.052	10.869	-0.065	0.006***	0.006**	0.004
	(0.615)	(-1.735)	(-1.285)	(0.269)	(1.407)	(-1.423)	(3.298)	(2.440)	(0.725)
Mgt	0.021	0.149*	0.083	0.214	5.252	0.091	0.000	0.008	0.006
	(1.159)	(1.832)	(1.317)	(0.887)	(0.621)	(0.907)	(0.118)	(1.545)	(0.846)
ln_Sales	0.020	0.549**	0.156***	0.355	-26.770	0.319*	-0.008***	-0.014***	-0.018***
	(1.080)	(2.050)	(3.060)	(0.992)	(-1.478)	(1.905)	(-3.226)	(-3.792)	(-3.994)
MTB	-0.000	0.001	0.001	-0.002	0.121	-0.002*	-0.000	-0.000	-0.000
	(-0.114)	(0.076)	(0.596)	(-0.278)	(1.559)	(-1.722)	(-1.129)	(-1.201)	(-1.592)
DARatio	-0.268***	-1.885***	-0.310	0.310	46.485	-0.808*	0.032**	0.034	0.057
	(-3.914)	(-5.104)	(-1.268)	(0.470)	(1.327)	(-1.752)	(2.209)	(1.569)	(1.310)
Emp	0.000	-0.000	0.000	-0.000	0.000	0.000**	0.000	0.000***	0.000***
	(0.628)	(-1.165)	(0.023)	(-1.058)	(0.097)	(2.020)	(1.313)	(2.922)	(3.611)
Constant	-0.242	-10.439*	-2.981***	-7.004	556.015	-6.410*	0.158***	0.298***	0.356***
	(-0.616)	(-1.851)	(-2.766)	(-0.976)	(1.460)	(-1.881)	(3.232)	(4.029)	(3.519)
Firm-year Obs.	338	336	337	335	289	289	324	326	326
Obs.	63	63	63	63	58	60	61	61	61
No. of Instruments	80	80	80	80	80	80	80	80	80
Wald Chi2	87.850	123.010	112.630	1290.970	90.870	239.190	74.060	83.440	57.710
Prob. > Chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Robust z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.6: Panel regression results for the energy sector
This table presents the dynamic panel estimation for the effects of sustainability category scores on the financial performance and equity risk of companies in the energy sector. The coefficients are estimated in accordance with equation (1) using the one-step system GMM estimator introduced by Arellano and Bond (1991) and Blundell and Bond (1998). The dependent variables are the accounting-based measures *ROA* in model (1), *ROE* in model (2), *ROS* in model (3), the market-based measures *TobinsQ* in model (4), *PE* in model (5), *DYield* in model (6), as well as the equity risk measures *Vol* in model (7), *VaR* in model (8), and *CVaR* in model (9). *Lag. Dep. Var.* refers to the lagged value of the

respective dependent variable. *Obs.* indicates the number of firms in each model. Detailed descriptions of all variables are presented in Table A.1 in Online Appendix A. The standard errors are robust, and the z-statistics are reported in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Energy									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	ROA	ROE	ROS	TobinsQ	PE	DYield	Vol	VaR	CVaR
Lag. Dep. Var.	-0.381	0.049	0.153**	0.407*	-0.256	0.481***	0.004	-0.133	-0.204**
	(-1.180)	(0.677)	(2.518)	(1.881)	(-1.203)	(2.686)	(0.041)	(-1.376)	(-2.120)
Emission	-0.136	-0.833	1.218	-0.274	-17.275	-0.231	0.008	0.033*	0.032
	(-0.696)	(-1.145)	(0.915)	(-0.946)	(-0.289)	(-0.925)	(0.642)	(1.814)	(1.222)
RUse	0.143	0.718*	-0.902	0.661*	65.640	-0.055	0.006	0.007	0.009
	(0.851)	(1.646)	(-1.070)	(1.707)	(0.722)	(-0.491)	(0.648)	(0.500)	(0.342)
EInnovation	0.038	0.178	0.467	-0.065	188.261	0.228**	0.007	0.007	-0.001
	(0.696)	(0.713)	(0.516)	(-0.533)	(1.253)	(2.111)	(1.356)	(0.962)	(-0.070)
Comm	0.023	0.002	-0.447	-0.048	-7.733	-0.089	-0.008	-0.009	-0.017
	(0.299)	(0.011)	(-0.593)	(-0.225)	(-0.310)	(-0.999)	(-1.258)	(-1.021)	(-1.144)
HR	0.115	0.598	-1.540	0.119	-38.532	0.151	0.007	0.014**	0.031*
	(1.517)	(1.320)	(-1.587)	(0.628)	(-0.862)	(1.095)	(1.077)	(1.974)	(1.829)
PRes	0.126	0.294	0.618	0.007	10.022	-0.002	-0.005	-0.011	-0.022
	(1.402)	(0.703)	(0.506)	(0.038)	(0.294)	(-0.016)	(-0.752)	(-0.888)	(-1.207)
WForce	-0.008	0.413	1.028	0.018	-38.150	-0.005	-0.014	-0.022	-0.007
	(-0.092)	(1.036)	(1.296)	(0.054)	(-0.660)	(-0.024)	(-1.286)	(-1.378)	(-0.273)
CSRStrat	-0.090	-0.347	0.623	0.163	4.668	0.259	0.006	0.010	0.027
	(-1.612)	(-1.158)	(1.216)	(0.511)	(0.116)	(1.238)	(0.988)	(1.253)	(1.559)
SH	-0.071	-0.386*	0.392	0.062	23.787	0.180	-0.003	-0.001	-0.008
	(-0.985)	(-1.780)	(0.785)	(0.679)	(1.363)	(1.365)	(-0.523)	(-0.148)	(-0.619)
Mgt	0.100	0.299	0.984	0.037	-16.661	-0.064	0.000	0.005	0.012
	(0.998)	(0.682)	(1.088)	(0.288)	(-0.848)	(-0.579)	(0.005)	(0.533)	(0.683)
ln_Sales	0.035*	-0.046	0.027	-0.076	-14.598	0.112	-0.007***	-0.013***	-0.029***
	(1.702)	(-0.542)	(0.105)	(-0.632)	(-1.588)	(1.109)	(-4.461)	(-5.058)	(-7.754)
MTB	0.029**	-0.138**	-0.040	0.255**	2.400	-0.035	-0.002***	-0.002	-0.004*
	(2.533)	(-2.315)	(-0.406)	(2.017)	(0.651)	(-1.591)	(-2.750)	(-1.460)	(-1.681)
DARatio	-0.809***	-0.773	-0.714	-2.149***	74.093	0.650	0.048***	0.031	0.042
	(-3.381)	(-1.396)	(-0.391)	(-2.593)	(1.191)	(1.081)	(3.059)	(1.310)	(1.430)
Emp	-0.000*	0.000	0.000	0.000	0.000	-0.000	0.000*	0.000**	0.000***
	(-1.817)	(0.169)	(0.599)	(0.224)	(0.028)	(-0.551)	(1.875)	(2.115)	(2.781)
Constant	-0.373	1.208	-1.611	2.446	278.612	-2.827	0.152***	0.295***	0.640***
	(-0.745)	(0.817)	(-0.315)	(0.811)	(1.403)	(-1.158)	(4.567)	(5.368)	(7.592)
Firm-year Obs.	194	194	180	193	138	156	189	189	189
Obs.	39	39	37	39	33	33	38	38	38
No. of Instruments	80	80	80	80	80	80	79	79	79
Wald Chi2	129.490	87.600	181.820	1155.990	22.040	687.430	122.980	103.080	162.410
Prob. > Chi2	0.000	0.000	0.000	0.000	0.107	0.000	0.000	0.000	0.000

Robust z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.7: Panel regression results for the financial sector
This table presents the dynamic panel estimation for the effects of sustainability category scores on the financial performance and equity risk of companies in the financial sector. The coefficients are estimated in accordance with equation (1) using the one-step system GMM estimator introduced by Arellano and Bond (1991) and Blundell and Bond (1998). The dependent variables are the accounting-based measures *ROA* in model (1), *ROE* in model (2), *ROS* in model (3), the market-based measures *TobinsQ* in model (4), *PE* in model (5), *DYield* in model (6), as well as the equity risk measures *Vol* in model (7), *VaR* in model (8), and *CVaR* in model (9). *Lag. Dep. Var.* refers to the lagged value of the respective dependent variable. *Obs.* indicates the number of firms in each model. Detailed descriptions of all variables are presented in Table A.1 in Online Appendix A. The standard errors are robust, and z-statistics are reported in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Financials									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	ROA	ROE	ROS	TobinsQ	PE	DYield	Vol	VaR	CVaR
Lag. Dep. Var.	-0.196***	-0.095	0.070	0.093	0.052	0.016	-0.157***	-0.280***	-0.336***
	(-3.096)	(-1.267)	(0.412)	(1.372)	(0.513)	(0.180)	(-3.160)	(-4.763)	(-6.942)
Emission	0.013	-0.066	-0.165	-0.037	-17.622	-0.016	-0.001	0.003	0.006
	(0.462)	(-1.470)	(-1.289)	(-0.315)	(-1.207)	(-1.257)	(-0.284)	(0.486)	(0.621)
RUse	-0.068**	-0.040	0.135	0.002	18.613	0.031*	0.009	0.008	0.022
	(-2.424)	(-0.520)	(0.742)	(0.012)	(0.799)	(1.817)	(1.281)	(0.918)	(1.390)
EInnovation	-0.031***	-0.062	0.078	0.200*	13.336	-0.014	0.010**	0.002	0.003
	(-2.849)	(-1.354)	(0.611)	(1.865)	(1.479)	(-0.975)	(2.342)	(0.289)	(0.276)
Comm	-0.003	0.031	-0.171	-0.172	5.289	-0.015	-0.006	-0.013	-0.013
	(-0.167)	(0.510)	(-1.379)	(-1.244)	(0.297)	(-0.998)	(-1.129)	(-1.199)	(-1.052)
HR	0.016	0.051	-0.165**	-0.036	-4.132	0.012	0.003	0.000	0.001
	(0.759)	(0.921)	(-2.088)	(-0.473)	(-0.414)	(1.286)	(0.804)	(0.004)	(0.136)
PRes	0.000	0.013	-0.074	-0.098	-8.273	0.010	-0.002	-0.004	-0.006
	(0.028)	(0.381)	(-0.581)	(-1.064)	(-0.675)	(0.784)	(-0.322)	(-0.522)	(-0.600)
WForce	-0.001	0.163**	0.131	-0.031	-4.667	0.019	-0.014***	-0.012*	-0.021
	(-0.066)	(2.435)	(0.789)	(-0.219)	(-0.326)	(1.252)	(-2.773)	(-1.865)	(-1.406)
CSRStrat	0.024	0.047	0.019	0.165*	-14.025	-0.033**	-0.002	-0.001	-0.004
	(1.247)	(1.088)	(0.268)	(1.925)	(-1.119)	(-2.100)	(-0.291)	(-0.176)	(-0.294)
SH	-0.002	0.002	0.054	-0.039	7.129	0.005	-0.001	0.003	0.004
	(-0.144)	(0.053)	(1.325)	(-0.629)	(0.830)	(0.479)	(-0.261)	(0.828)	(0.466)
Mgt	0.024	-0.012	-0.090	0.237	7.197	-0.005	0.009	0.019**	0.034***
	(1.338)	(-0.311)	(-0.839)	(1.591)	(0.910)	(-0.524)	(1.528)	(2.079)	(3.091)
ln_Sales	0.007	0.073***	0.181**	-0.169**	8.854	0.003	-0.000	0.004	-0.002
	(0.394)	(2.670)	(2.359)	(-1.976)	(1.605)	(0.546)	(-0.261)	(1.091)	(-0.306)
MTB	0.002	0.000	0.027*	0.301***	5.902**	-0.008***	-0.001	-0.002*	-0.002*
	(1.453)	(0.027)	(1.789)	(9.455)	(1.998)	(-4.651)	(-1.604)	(-1.956)	(-1.830)
DARatio	-0.077**	-0.049	0.102	-0.285	-4.576	-0.002	0.012*	0.018**	0.008
	(-2.168)	(-0.552)	(1.042)	(-0.906)	(-0.544)	(-0.199)	(1.862)	(2.284)	(0.604)
Emp	-0.000	-0.000	-0.000	-0.000	-0.001	-0.000	-0.000*	-0.000	-0.000
	(-0.072)	(-0.755)	(-1.594)	(-0.646)	(-1.577)	(-1.007)	(-1.722)	(-1.168)	(-1.551)
Constant	-0.040	-1.445**	-3.353**	3.598*	-159.433	0.001	0.031	-0.056	0.095
	(-0.123)	(-2.566)	(-2.302)	(1.951)	(-1.463)	(0.008)	(0.891)	(-0.724)	(0.965)
Firm-year Obs.	664	664	160	654	545	551	624	626	626
Obs.	128	128	36	128	118	115	123	123	123
No. of Instruments	80	80	80	80	80	80	78	80	80
Wald Chi2	83.960	32.630	90.210	499.140	17.700	44.450	47.480	86.720	126.350
Prob. > Chi2	0.000	0.005	0.000	0.000	0.279	0.000	0.000	0.000	0.000

Robust z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.8: Panel regression results for the health care sector
This table presents the dynamic panel estimation for the effects of sustainability category scores on the financial performance and equity risk of companies in the health care sector. The coefficients are estimated in accordance with equation (1) using the one-step system GMM estimator introduced by Arellano and Bond (1991) and Blundell and Bond (1998). The dependent variables are the accounting-based measures *ROA* in model (1), *ROE* in model (2), *ROS* in model (3), the market-based measures *TobinsQ* in model (4), *PE* in model (5), *DYield* in model (6), as well as the equity risk measures *Vol* in model (7), *VaR* in model (8), and *CVaR* in model (9). *Lag. Dep. Var.* refers to the lagged value of the respective dependent variable. *Obs.* indicates the number of firms in each model. Detailed descriptions of all variables are presented in Table A.1 in Online Appendix A. The standard errors are robust, and the z-statistics are reported in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Health Care									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

	ROA	ROE	ROS	TobinsQ	PE	DYield	Vol	VaR	CVaR
Lag. Dep. Var.	0.125	0.125	0.911***	0.230**	-0.039	0.050	-0.073	-0.192***	-0.190***
	(0.571)	(0.571)	(3.986)	(2.283)	(-0.990)	(0.318)	(-0.996)	(-2.997)	(-2.750)
Emission	0.012	0.012	-2.811**	-0.093	57.000**	-0.002	0.001	0.001	0.007
	(0.146)	(0.146)	(-2.008)	(-0.243)	(2.169)	(-0.222)	(0.190)	(0.280)	(0.781)
RUse	-0.001	-0.001	-0.987	0.910	25.896	-0.025***	-0.005	-0.006	-0.016
	(-0.024)	(-0.024)	(-0.721)	(1.422)	(0.396)	(-2.726)	(-1.015)	(-1.016)	(-1.485)
EInnovation	0.084	0.084	0.343	-0.124	-37.279	-0.005	0.002	-0.001	-0.005
	(1.081)	(1.081)	(0.521)	(-0.389)	(-1.446)	(-0.914)	(0.709)	(-0.148)	(-0.630)
Comm	-0.024	-0.024	0.142	-0.936	8.567	-0.008	-0.003	-0.006	-0.015*
	(-0.351)	(-0.351)	(0.179)	(-1.602)	(0.316)	(-1.109)	(-1.156)	(-1.512)	(-1.665)
HR	0.016	0.016	0.571	0.052	78.700***	-0.002	0.002	0.000	0.006
	(0.281)	(0.281)	(0.755)	(0.092)	(2.612)	(-0.400)	(0.710)	(0.015)	(0.701)
PRes	0.041	0.041	0.322	-0.703	36.577	-0.000	0.002	0.002	0.003
	(0.835)	(0.835)	(0.293)	(-0.758)	(0.853)	(-0.027)	(1.115)	(0.838)	(0.466)
WForce	0.089	0.089	4.124	1.036	-68.337	0.008	-0.008	0.006	0.010
	(0.735)	(0.735)	(1.292)	(1.309)	(-1.184)	(1.330)	(-1.069)	(1.123)	(0.772)
CSRStrat	-0.056	-0.056	-0.803	-0.278	4.675	0.005	0.004	0.012***	0.016**
	(-0.638)	(-0.638)	(-0.888)	(-0.671)	(0.167)	(1.016)	(1.280)	(3.503)	(2.102)
SH	-0.022	-0.022	-0.679	0.632	-35.473	0.002	0.006	0.007	0.009
	(-0.288)	(-0.288)	(-0.528)	(1.033)	(-0.904)	(0.436)	(1.016)	(1.421)	(1.013)
Mgt	-0.051	-0.051	-0.037	-0.515	-12.730	0.001	0.002	0.006	0.011
	(-0.586)	(-0.586)	(-0.022)	(-0.810)	(-0.510)	(0.233)	(0.446)	(1.413)	(1.105)
ln_Sales	0.145***	0.145***	2.307***	-0.118	-50.798**	0.004	-0.001**	-0.002*	-0.004*
	(3.113)	(3.113)	(2.708)	(-0.720)	(-2.550)	(1.350)	(-2.138)	(-1.782)	(-1.779)
MTB	0.003	0.003	-0.023	0.320***	3.148**	-0.000**	-0.000	-0.000	-0.000
	(1.475)	(1.475)	(-0.653)	(4.867)	(2.233)	(-2.465)	(-0.538)	(-0.340)	(-0.789)
DARatio	-0.817**	-0.817**	3.051	-4.602***	-124.508*	0.028***	0.003	0.003	-0.002
	(-2.490)	(-2.490)	(1.154)	(-3.040)	(-1.739)	(3.904)	(0.502)	(0.505)	(-0.126)
Emp	-0.000	-0.000	-0.000*	0.000	-0.000	0.000	-0.000	-0.000	-0.000
	(-0.588)	(-0.588)	(-1.849)	(0.619)	(-0.002)	(0.250)	(-0.517)	(-1.485)	(-0.824)
Constant	-2.525***	-2.525***	-46.827***	4.425	1,111.739***	-0.064	0.056***	0.064***	0.131***
	(-3.047)	(-3.047)	(-2.615)	(1.551)	(2.790)	(-1.200)	(4.473)	(3.738)	(3.021)
Firm-year Obs.	514	514	455	508	343	311	494	494	492
Obs.	133	133	116	132	83	71	131	131	131
No. of Instruments	80	80	80	80	80	80	80	80	80
Wald Chi2	551.140	551.140	382.340	343.210	45.130	110.290	53.830	49.580	54.420
Prob. > Chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Robust z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.9: Panel regression results for the industrials sector
This table presents the dynamic panel estimation for the effects of sustainability category scores on the financial performance and equity risk of companies in the industrials sector. The coefficients are estimated in accordance with equation (1) using the one-step system GMM estimator introduced by Arellano and Bond (1991) and Blundell and Bond (1998). The dependent variables are the accounting-based measures *ROA* in model (1), *ROE* in model (2), *ROS* in model (3), the market-based measures *TobinsQ* in model (4), *PE* in model (5), *DYield* in model (6), as well as the equity risk measures *Vol* in model (7), *VaR* in model (8), and *CVaR* in model (9). *Lag. Dep. Var.* refers to the lagged value of the respective dependent variable. *Obs.* indicates the number of firms in each model. Detailed descriptions of all variables are presented in Table A.1 in Online Appendix A. The standard errors are robust, and the z-statistics are reported in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Industrials									
	(1) ROA	(2) ROE	(3) ROS	(4) TobinsQ	(5) PE	(6) DYield	(7) Vol	(8) VaR	(9) CVaR
Lag. Dep. Var.	0.023	0.100	-0.323*	0.228**	0.172**	0.036	-0.242***	-0.281***	-0.420***

	(0.222)	(1.216)	(-1.677)	(2.381)	(2.259)	(0.377)	(-5.026)	(-6.553)	(-9.048)
Emission	-0.002	-0.267***	-0.001	-0.243	19.825	0.002	0.006*	0.010**	0.018***
	(-0.119)	(-2.822)	(-0.004)	(-1.275)	(0.990)	(0.197)	(1.756)	(2.454)	(2.673)
RUse	-0.012	0.012	0.364	-0.023	3.709	-0.018	0.001	-0.002	-0.000
	(-0.593)	(0.155)	(1.288)	(-0.108)	(0.272)	(-1.146)	(0.470)	(-0.413)	(-0.009)
EInnovation	0.006	0.173***	-0.049	-0.011	-45.333*	-0.022**	0.001	-0.007**	0.001
	(0.489)	(2.962)	(-0.283)	(-0.035)	(-1.712)	(-2.329)	(0.500)	(-2.026)	(0.129)
Comm	-0.005	-0.052	0.520*	-0.055	18.039	-0.021***	0.005**	0.009**	0.014**
	(-0.511)	(-0.752)	(1.663)	(-0.180)	(0.946)	(-2.686)	(1.977)	(2.486)	(2.035)
HR	-0.023**	-0.011	-0.143	-0.223	-0.011	-0.001	-0.004**	-0.007**	-0.003
	(-2.374)	(-0.155)	(-1.097)	(-0.993)	(-0.001)	(-0.159)	(-2.470)	(-2.519)	(-0.738)
PRes	0.010	0.004	-0.086	0.046	-19.475	0.034	0.001	0.003	0.006
	(0.737)	(0.092)	(-0.734)	(0.293)	(-1.252)	(1.637)	(0.548)	(1.020)	(0.952)
WForce	0.006	0.158	0.338	-0.024	22.782	-0.030*	-0.005	-0.003	-0.008
	(0.272)	(1.493)	(1.450)	(-0.111)	(0.791)	(-1.805)	(-1.635)	(-0.794)	(-1.086)
CSRStrat	-0.021	-0.055	-0.181*	0.093	12.077	0.003	0.005**	0.009***	0.013**
	(-1.579)	(-1.056)	(-1.763)	(0.403)	(1.271)	(0.483)	(2.282)	(3.245)	(2.556)
SH	0.009	0.080	0.157	-0.025	-3.969	-0.015**	0.003	0.002	0.007
	(1.022)	(1.329)	(1.083)	(-0.191)	(-0.316)	(-2.029)	(1.536)	(0.699)	(1.439)
Mgt	-0.005	-0.022	-0.197	-0.059	26.051**	-0.006	0.005**	0.012***	0.015***
	(-0.284)	(-0.409)	(-1.529)	(-0.271)	(2.091)	(-0.947)	(2.176)	(4.810)	(2.928)
ln_Sales	0.051***	0.072	-0.071	-0.188**	-11.898	0.018***	-0.010***	-0.009***	-0.020***
	(4.892)	(0.915)	(-0.308)	(-1.974)	(-0.598)	(3.320)	(-7.768)	(-6.666)	(-6.237)
MTB	0.000	0.013**	-0.005	0.275***	0.869*	-0.001*	-0.000	-0.000	-0.000
	(0.304)	(2.112)	(-0.614)	(5.228)	(1.799)	(-1.938)	(-0.593)	(-1.155)	(-0.919)
DARatio	-0.188***	-0.520***	-0.808	-4.171***	117.538**	0.027	0.030***	0.042***	0.047***
	(-4.885)	(-2.778)	(-1.326)	(-4.471)	(2.263)	(1.206)	(4.594)	(4.741)	(3.406)
Emp	-0.000	-0.000	0.000	0.000	0.000	-0.000	0.000**	0.000	0.000
	(-1.504)	(-1.376)	(0.554)	(0.083)	(0.203)	(-0.289)	(2.213)	(0.661)	(0.344)
Constant	-0.901***	-1.099	1.804	6.890***	176.854	-0.328***	0.205***	0.201***	0.442***
	(-4.285)	(-0.667)	(0.379)	(3.308)	(0.420)	(-2.899)	(7.936)	(7.061)	(6.671)
Firm-year Obs.	1,367	1,360	1,337	1,352	1,041	1,109	1,322	1,316	1,322
Obs.	321	321	313	316	263	264	309	309	309
No. of Instruments	80	80	80	80	80	80	80	80	80
Wald Chi2	86.600	60.300	34.430	571.040	35.060	43.790	187.730	197.640	320.850
Prob. > Chi2	0.000	0.000	0.003	0.000	0.002	0.000	0.000	0.000	0.000

Robust z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.10: Panel regression results for the information technologies sector
This table presents the dynamic panel estimation for the effects of sustainability category scores on the financial performance and equity risk of companies in the information technologies sector. The coefficients are estimated in accordance with equation (1) using the one-step system GMM estimator introduced by Arellano and Bond (1991) and Blundell and Bond (1998). The dependent variables are the accounting-based measures *ROA* in model (1), *ROE* in model (2), *ROS* in model (3), the market-based measures *TobinsQ* in model (4), *PE* in model (5), *DYield* in model (6), as well as the equity risk measures *Vol* in model (7), *VaR* in model (8), and *CVaR* in model (9). *Lag. Dep. Var.* refers to the lagged value of the respective dependent variable. *Obs.* indicates the number of firms in each model. Detailed descriptions of all variables are presented in Table A.1 in Online Appendix A. The standard errors are robust, and the z-statistics are reported in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Information Technologies									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	ROA	ROE	ROS	TobinsQ	PE	DYield	Vol	VaR	CVaR
Lag. Dep. Var.	0.227*	0.384*	0.031	0.333**	0.088	0.040	-0.171*	-0.290***	-0.387***
	(1.772)	(1.737)	(0.329)	(2.479)	(1.528)	(0.440)	(-1.741)	(-2.735)	(-3.893)

Emission	-0.047	0.051	-0.180	-1.587	-26.513	0.041	-0.001	-0.006	0.007
	(-0.866)	(0.331)	(-0.632)	(-0.966)	(-0.779)	(1.631)	(-0.229)	(-0.923)	(0.696)
RUse	-0.016	0.446*	-0.212	-1.267	51.372	-0.008	0.004	0.003	0.007
	(-0.354)	(1.723)	(-1.272)	(-0.821)	(1.456)	(-0.627)	(0.851)	(0.539)	(0.566)
EInnovation	-0.057	-0.226	0.032	0.580	12.925	0.013	0.008*	0.002	0.019**
	(-1.270)	(-1.468)	(0.090)	(0.809)	(0.511)	(1.069)	(1.652)	(0.298)	(1.968)
Comm	0.025	-0.382	-0.401	-1.041	70.498	-0.003	0.002	0.008	0.019
	(0.644)	(-1.550)	(-1.151)	(-1.143)	(1.011)	(-0.200)	(0.528)	(1.346)	(1.248)
HR	-0.020	0.052	-0.024	0.807	-31.802*	0.012	-0.004	-0.002	-0.011
	(-0.431)	(0.471)	(-0.136)	(1.289)	(-1.752)	(1.585)	(-1.136)	(-0.553)	(-1.244)
PRes	0.124*	-0.041	-0.025	1.111	22.644	-0.021	0.001	0.002	-0.002
	(1.718)	(-0.201)	(-0.159)	(0.866)	(1.199)	(-1.530)	(0.203)	(0.272)	(-0.195)
WForce	0.063	0.120	0.495	0.477	26.919	-0.041	-0.018**	-0.024***	-0.044***
	(1.348)	(0.573)	(1.549)	(0.337)	(0.682)	(-1.563)	(-2.549)	(-3.081)	(-2.705)
CSRStrat	-0.111**	-0.244	-0.151	-0.405	17.723	0.006	0.005	0.010*	0.011
	(-2.327)	(-1.328)	(-0.896)	(-0.401)	(0.805)	(0.564)	(1.180)	(1.752)	(1.209)
SH	-0.011	0.034	0.180**	0.242	-2.372	0.006	0.014***	0.014***	0.030***
	(-0.324)	(0.278)	(2.253)	(0.272)	(-0.086)	(0.717)	(4.476)	(3.092)	(4.174)
Mgt	-0.024	-0.096	0.022	-0.595	-17.579	-0.003	-0.001	0.007	0.008
	(-0.804)	(-0.586)	(0.148)	(-0.839)	(-0.507)	(-0.449)	(-0.153)	(1.144)	(0.592)
ln_Sales	0.087***	0.119	0.385***	-0.090	-6.326	-0.007	-0.001	-0.001	-0.002
	(3.479)	(0.947)	(3.243)	(-0.362)	(-0.725)	(-0.889)	(-0.887)	(-0.428)	(-0.604)
MTB	0.001	0.016***	0.002	0.058***	0.186	-0.000	-0.000	-0.000	-0.000***
	(1.424)	(3.353)	(1.021)	(3.027)	(1.244)	(-0.792)	(-1.480)	(-1.136)	(-2.583)
DARatio	0.026	-0.040	0.515***	-0.717	-93.948	0.008	-0.008	-0.013	-0.015
	(0.515)	(-0.175)	(3.146)	(-0.728)	(-1.326)	(0.455)	(-1.385)	(-1.542)	(-0.937)
Emp	-0.000	-0.000	-0.000**	-0.000	-0.000	0.000	-0.000	-0.000	-0.000
	(-1.592)	(-1.131)	(-2.005)	(-0.377)	(-0.645)	(1.393)	(-0.296)	(-0.167)	(-1.323)
Constant	-1.666***	-2.228	-7.653***	4.110	153.418	0.163	0.064**	0.084	0.130*
	(-3.656)	(-0.868)	(-3.257)	(0.748)	(0.817)	(1.080)	(2.176)	(1.358)	(1.872)
Firm-year Obs.	415	413	413	409	293	267	397	397	397
Obs.	142	141	140	141	114	90	134	134	134
No. of Instruments	79	79	79	79	79	79	79	79	79
Wald Chi2	179.420	72.130	67.310	103.770	60.440	41.790	51.630	67.920	100.930
Prob. > Chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Robust z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.11: Panel regression results for the materials sector
This table presents the dynamic panel estimation for the effects of sustainability category scores on the financial performance and equity risk of companies in the materials sector. The coefficients are estimated in accordance with equation (1) using the one-step system GMM estimator introduced by Arellano and Bond (1991) and Blundell and Bond (1998). The dependent variables are the accounting-based measures *ROA* in model (1), *ROE* in model (2), *ROS* in model (3), the market-based measures *TobinsQ* in model (4), *PE* in model (5), *DYield* in model (6), as well as the equity risk measures *Vol* in model (7), *VaR* in model (8), and *CVaR* in model (9). *Lag. Dep. Var.* refers to the lagged value of the respective dependent variable. *Obs.* indicates the number of firms in each model. Detailed descriptions of all variables are presented in Table A.1 in Online Appendix A. The standard errors are robust, and the z-statistics are reported in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Materials									
	(1) ROA	(2) ROE	(3) ROS	(4) TobinsQ	(5) PE	(6) DYield	(7) Vol	(8) VaR	(9) CVaR
Lag. Dep. Var.	0.396***	0.359***	-0.144	0.105	-0.059	0.133	0.027	-0.022	-0.206***
	(4.322)	(2.810)	(-0.816)	(0.821)	(-0.950)	(0.633)	(0.502)	(-0.477)	(-3.918)
Emission	0.013	0.176	-0.607	-0.447	37.466	0.023	0.004	0.008	0.014
	(0.422)	(1.555)	(-1.570)	(-0.628)	(0.630)	(0.788)	(0.777)	(1.040)	(1.162)
RUse	0.031	0.065	-1.173	1.188	-4.493	-0.005	-0.009	-0.008	-0.018
	(0.723)	(0.531)	(-1.335)	(1.432)	(-0.132)	(-0.243)	(-1.623)	(-1.306)	(-1.565)

EInnovation	-0.042*	-0.009	0.859*	0.150	-14.808	0.014	-0.006	-0.003	-0.013
	(-1.936)	(-0.065)	(1.830)	(0.446)	(-0.737)	(0.630)	(-1.213)	(-0.538)	(-1.336)
Comm	0.026	-0.074	-0.439	0.136	5.376	-0.027	-0.006**	-0.007**	-0.008
	(1.004)	(-0.734)	(-1.185)	(0.703)	(0.233)	(-1.477)	(-2.080)	(-2.219)	(-1.385)
HR	-0.025	-0.017	0.307	0.661*	-8.086	-0.021	0.007*	0.001	0.012*
	(-0.941)	(-0.183)	(1.390)	(1.913)	(-0.350)	(-1.127)	(1.841)	(0.215)	(1.777)
PRes	-0.022	-0.177	0.151	0.186	-19.396	-0.012	0.006	0.002	0.003
	(-0.882)	(-1.333)	(0.652)	(0.741)	(-1.053)	(-0.780)	(1.484)	(0.365)	(0.440)
WForce	0.046	0.468**	0.382	0.248	33.729	0.003	0.001	0.003	0.015
	(1.410)	(2.133)	(0.626)	(0.666)	(0.808)	(0.182)	(0.274)	(0.553)	(1.255)
CSRStrat	-0.025	0.008	-0.273	-0.346	19.590	0.012	0.001	0.005	0.004
	(-0.954)	(0.062)	(-1.167)	(-1.508)	(0.754)	(0.859)	(0.437)	(1.194)	(0.549)
SH	-0.060*	-0.153	-0.133	-0.200	0.183	0.005	0.001	0.004*	0.009*
	(-1.835)	(-1.615)	(-0.879)	(-0.672)	(0.007)	(0.435)	(0.746)	(1.661)	(1.947)
Mgt	0.033	0.019	-0.108	-0.322	-26.422	-0.024	0.006*	0.009**	0.017**
	(0.637)	(0.133)	(-0.381)	(-0.943)	(-1.204)	(-1.450)	(1.744)	(1.977)	(2.106)
ln_Sales	0.030**	0.109	0.648*	-0.440**	9.730	-0.009	-0.002	-0.003	-0.004
	(2.544)	(1.455)	(1.934)	(-2.386)	(0.395)	(-0.719)	(-1.149)	(-1.185)	(-0.772)
MTB	0.001	0.008	-0.002	0.013	-0.136	-0.006*	-0.000**	-0.000*	-0.000**
	(0.931)	(1.001)	(-0.472)	(0.602)	(-0.756)	(-1.815)	(-2.228)	(-1.929)	(-2.573)
DARatio	-0.242**	-0.826**	1.015	1.897	-95.328	-0.045	0.024**	0.016	0.055**
	(-2.436)	(-2.019)	(1.047)	(1.582)	(-1.602)	(-0.938)	(2.228)	(1.301)	(2.430)
Emp	-0.000	-0.000***	0.000	-0.000**	-0.000	0.000**	-0.000	-0.000	-0.000*
	(-1.380)	(-3.303)	(0.336)	(-2.308)	(-0.582)	(2.301)	(-0.212)	(-0.328)	(-1.813)
Constant	-0.474**	-2.031	-13.469*	9.552***	-151.251	0.252	0.054	0.090	0.100
	(-2.010)	(-1.304)	(-1.852)	(2.631)	(-0.299)	(0.960)	(1.348)	(1.569)	(0.951)
Firm-year Obs.	507	504	507	502	393	442	497	497	497
Obs.	93	93	93	92	83	81	89	89	89
No. of Instruments	80	80	80	80	80	80	80	80	80
Wald Chi2	215.170	1075.180	21.260	102.030	36.750	46.750	42.410	61.450	91.320
Prob. > Chi2	0.000	0.000	0.129	0.000	0.001	0.000	0.000	0.000	0.000

Robust z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.12: Panel regression results for the real estate sector

This table presents the dynamic panel estimation for the effects of sustainability category scores on the financial performance and equity risk of companies in the real estate sector. The coefficients are estimated in accordance with equation (1) using the one-step system GMM estimator introduced by Arellano and Bond (1991) and Blundell and Bond (1998). The dependent variables are the accounting-based measures *ROA* in model (1), *ROE* in model (2), *ROS* in model (3), the market-based measures *TobinsQ* in model (4), *PE* in model (5), *DYield* in model (6), as well as the equity risk measures *Vol* in model (7), *VaR* in model (8), and *CVaR* in model (9). *Lag. Dep. Var.* refers to the lagged value of the respective dependent variable. *Obs.* indicates the number of firms in each model. Detailed descriptions of all variables are presented in Table A.1 in Online Appendix A. The standard errors are robust, and the z-statistics are reported in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Real Estate									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	ROA	ROE	ROS	TobinsQ	PE	DYield	Vol	VaR	CVaR
Lag. Dep. Var.	0.101	-0.251	-0.048	0.343***	0.104	0.528***	-0.071	-0.146***	-0.200***
	(1.024)	(-1.632)	(-0.294)	(3.792)	(0.546)	(2.823)	(-1.011)	(-2.884)	(-3.301)
Emission	0.006	0.066	0.356*	0.005	57.083	-0.030	-0.002	0.003	-0.004
	(0.239)	(0.753)	(1.692)	(0.067)	(1.617)	(-0.703)	(-0.301)	(0.376)	(-0.172)
RUse	-0.045	-0.113	-0.105	-0.067	-20.614	-0.052	-0.009	-0.023**	-0.014
	(-1.382)	(-1.342)	(-0.450)	(-0.903)	(-0.635)	(-1.074)	(-0.850)	(-2.232)	(-0.568)
EInnovation	0.033**	0.140***	0.019	0.134**	-13.865	0.021	0.005	0.004	0.011
	(2.049)	(2.919)	(0.248)	(2.553)	(-0.688)	(0.761)	(1.128)	(0.764)	(1.033)

Comm	0.005	0.068	0.095	-0.011	28.301	0.043**	-0.002	0.000	-0.013
	(0.253)	(1.323)	(0.627)	(-0.328)	(1.175)	(2.106)	(-0.335)	(0.028)	(-0.929)
HR	-0.014	-0.059	-0.028	0.012	19.451	0.043	0.001	0.004	-0.001
	(-1.211)	(-1.312)	(-0.298)	(0.362)	(1.351)	(1.453)	(0.346)	(0.832)	(-0.112)
PRes	-0.028**	-0.138***	-0.004	-0.053	20.427	-0.033*	0.002	0.006	0.007
	(-2.206)	(-2.882)	(-0.053)	(-0.766)	(1.114)	(-1.695)	(0.675)	(1.229)	(0.857)
WForce	0.030	0.021	-0.087	-0.043	19.452	-0.069	-0.015	-0.028**	-0.038
	(0.886)	(0.213)	(-0.483)	(-0.468)	(0.571)	(-0.936)	(-1.571)	(-2.452)	(-1.454)
CSRStrat	-0.037**	-0.233***	0.011	-0.077	-12.478	0.019	0.012***	0.018***	0.032***
	(-2.003)	(-2.840)	(0.127)	(-1.220)	(-0.550)	(0.648)	(2.591)	(3.173)	(2.922)
SH	-0.005	0.049	0.090	-0.014	-3.589	-0.083*	0.011**	0.005	0.019
	(-0.303)	(0.906)	(0.704)	(-0.336)	(-0.303)	(-1.726)	(2.410)	(0.930)	(1.637)
Mgt	-0.004	-0.083	-0.088	0.023	-15.654	-0.059***	0.007	0.010	0.022
	(-0.242)	(-1.514)	(-0.929)	(0.528)	(-0.676)	(-2.583)	(1.309)	(1.417)	(1.576)
ln_Sales	0.018	0.062	-0.066	-0.016	-20.400**	0.012	-0.003	0.000	0.005
	(1.215)	(1.250)	(-0.738)	(-0.644)	(-2.455)	(0.511)	(-1.251)	(0.091)	(0.643)
MTB	0.003	-0.030	-0.084*	0.177***	-12.416	-0.040***	-0.001	-0.001	-0.004
	(0.540)	(-1.154)	(-1.859)	(4.561)	(-1.208)	(-3.062)	(-0.789)	(-0.441)	(-1.008)
DARatio	-0.263***	-0.255	1.281**	-0.604*	101.009	0.077	0.048***	0.048***	0.110***
	(-3.463)	(-0.818)	(2.063)	(-1.959)	(1.633)	(0.907)	(3.920)	(2.706)	(3.424)
Emp	-0.000	-0.000	-0.000	-0.000	0.001	-0.000	0.000	0.000	0.000
	(-0.669)	(-0.144)	(-0.536)	(-0.584)	(0.297)	(-0.995)	(0.271)	(0.173)	(0.522)
Constant	-0.139	-0.740	1.486	0.840	346.352**	-0.053	0.062	0.008	-0.100
	(-0.510)	(-0.780)	(0.925)	(1.438)	(2.307)	(-0.113)	(1.209)	(0.118)	(-0.730)
Firm-year Obs.	301	299	295	296	258	276	288	288	288
Obs.	67	67	63	65	62	60	64	64	64
No. of Instruments	76	76	76	76	76	76	76	76	76
Wald Chi2	71.020	25.870	26.020	340.730	78.300	80.930	42.780	75.400	83.790
Prob. > Chi2	0.000	0.039	0.038	0.000	0.000	0.000	0.000	0.000	0.000

Robust z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A.13: Panel regression results for the utilities sector

This table presents the dynamic panel estimation for the effects of sustainability category scores on the financial performance and equity risk of companies in the utilities sector. The coefficients are estimated in accordance with equation (1) using the one-step system GMM estimator introduced by Arellano and Bond (1991) and Blundell and Bond (1998). The dependent variables are the accounting-based measures *ROA* in model (1), *ROE* in model (2), *ROS* in model (3), the market-based measures *TobinsQ* in model (4), *PE* in model (5), *DYield* in model (6), as well as the equity risk measures *Vol* in model (7), *VaR* in model (8), and *CVaR* in model (9). *Lag. Dep. Var.* refers to the lagged value of the respective dependent variable. *Obs.* indicates the number of firms in each model. Detailed descriptions of all variables are presented in Table A.1 in Online Appendix A. The standard errors are robust, and the z-statistics are reported in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Utilities									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	ROA	ROE	ROS	TobinsQ	PE	DYield	Vol	VaR	CVaR
Lag. Dep. Var.	0.376***	0.254***	-0.085	0.145	0.017	0.012	-0.056	-0.046	-0.243**
	(2.812)	(4.465)	(-0.296)	(1.441)	(0.171)	(0.083)	(-0.536)	(-0.437)	(-2.491)
Emission	0.016	-0.120	0.310	0.132	-76.601	0.005	0.002	-0.005	0.001
	(0.382)	(-1.089)	(1.166)	(0.635)	(-1.396)	(0.177)	(0.254)	(-0.584)	(0.073)
RUse	-0.026	0.441	-0.339	0.128	34.238	0.022	-0.006	-0.006	-0.020
	(-0.673)	(1.598)	(-1.192)	(0.788)	(0.749)	(1.136)	(-1.268)	(-0.865)	(-1.522)
EInnovation	-0.010	0.088	-0.014	-0.217	-18.079	0.018	0.003	0.003	0.007
	(-0.775)	(0.982)	(-0.239)	(-1.594)	(-0.625)	(1.460)	(0.866)	(0.568)	(0.806)
Comm	0.010	0.042	-0.129	-0.105	-30.053	-0.016	0.013***	0.019***	0.045***
	(0.266)	(0.403)	(-1.128)	(-0.415)	(-0.486)	(-0.744)	(2.637)	(3.160)	(3.562)

HR	0.023	-0.249	0.308**	0.226**	-16.296	0.014	0.001	-0.000	0.006
	(0.930)	(-1.503)	(2.092)	(2.161)	(-0.675)	(0.541)	(0.117)	(-0.056)	(0.588)
PRes	0.030	-0.156	-0.210	0.105	20.475	0.007	-0.009**	-0.021***	-0.023*
	(1.369)	(-1.553)	(-1.237)	(0.601)	(0.648)	(0.295)	(-2.227)	(-2.902)	(-1.870)
WForce	-0.017	0.117	-0.049	-0.288**	2.793	-0.013	0.017***	0.022***	0.042***
	(-0.875)	(1.215)	(-0.301)	(-2.307)	(0.073)	(-0.625)	(3.799)	(3.066)	(3.049)
CSRStrat	0.074**	-0.189	0.242	0.269	22.551	-0.024*	0.008*	0.011*	0.009
	(2.344)	(-1.174)	(0.947)	(1.162)	(0.456)	(-1.789)	(1.805)	(1.709)	(0.698)
SH	-0.013	0.102	0.068	-0.001	-71.365	0.025	0.006**	0.016***	0.024***
	(-0.928)	(0.856)	(0.638)	(-0.008)	(-1.553)	(1.049)	(2.302)	(5.548)	(3.390)
Mgt	-0.031	-0.018	-0.110	0.065	18.254	-0.009	-0.003	-0.004	0.000
	(-1.626)	(-0.266)	(-1.634)	(0.652)	(0.943)	(-0.598)	(-1.377)	(-0.757)	(0.050)
ln_Sales	0.001	-0.070	0.074	-0.042	2.167	0.004	-0.005***	-0.005*	-0.009**
	(0.123)	(-1.279)	(0.897)	(-0.571)	(0.116)	(0.978)	(-3.424)	(-1.708)	(-2.143)
MTB	0.002	-0.007	0.022	0.137**	25.727**	-0.008**	-0.000	-0.000	0.001
	(0.770)	(-0.393)	(0.837)	(2.562)	(2.101)	(-2.420)	(-0.642)	(-0.507)	(0.954)
DARatio	-0.074**	0.126	-0.066	-0.483*	157.632	-0.002	-0.019***	-0.017**	-0.084***
	(-2.415)	(0.922)	(-0.250)	(-1.848)	(1.577)	(-0.034)	(-3.301)	(-2.122)	(-4.643)
Emp	-0.000	0.000	-0.000	-0.000	-0.002	-0.000	0.000*	0.000*	0.000*
	(-0.464)	(0.417)	(-0.582)	(-1.176)	(-1.420)	(-0.238)	(1.815)	(1.915)	(1.674)
Constant	0.003	1.452	-1.084	1.546	-71.301	-0.045	0.122***	0.124*	0.238**
	(0.017)	(1.196)	(-0.715)	(1.055)	(-0.183)	(-0.492)	(3.765)	(1.951)	(2.550)
Firm-year Obs.	234	234	227	233	203	202	230	230	230
Obs.	39	39	38	39	38	36	39	39	39
No. of Instruments	80	80	79	80	80	80	80	80	80
Wald Chi2	81.400	198.320	37.320	289.330	105.300	56.470	199.990	168.190	192.580
Prob. > Chi2	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000

Robust z-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Online Appendix B

Endogeneity problems and description of the Arellano-Bover/Blundell-Bond estimator

One of the most frequently occurring problems in empirical analyses of cross-sectional data is that of endogeneity. In simplified terms, endogeneity describes the correlation of the independent variable with the error term of a regression. It may be triggered by omitted variables, reverse causality between the dependent and explanatory variables, or measurement errors. If these issues are not adequately addressed, biased estimates may result (Roberts and Whited 2013).

Omitted variables refer to the problem of leaving out important explanatory variables in a regression. The most common reason for omitted variables relates to observability, such that it is simply not always possible to observe the relevant effects, to measure and include them in a regression. The problem of reverse causality describes the inverse relationship between the dependent and explanatory variable. While it is assumed that the explanatory variable influences the dependent variable, with reverse causality this relationship is exactly the opposite, as the dependent variable influences the explanatory variable. Measurement errors describe the problem of incorrectly measured variables that do not reflect their true value. Measurement errors may also arise from the use of unsuitable proxy variables for unobservable effects. Measurement errors can occur in both dependent and explanatory variables (Roberts and Whited 2013).

To address these issues in our estimates, we use several techniques. To reduce bias from omitted variables, we include a variety of firm-specific control variables in our regressions. These are intended to capture additional effects on the dependent variable. To address the problem of reverse causality, we use the one-step Arellano-Bover/Blundell-Bond estimator for linear dynamic panel data estimation in our regression models. This estimator correlates the unobserved effects at the panel level with the lags of the dependent variable. To achieve this, a linear dynamic panel data model is constructed, which includes p lags of the dependent variable as covariates. In our case, we use 1 lag of the dependent variables. This accounts for fixed or random unobservable effects at the panel level. The inclusion of the lagged dependent variable aims to mitigate the effects of time-varying omitted variables. By incorporating the lagged dependent variable, we reduce endogeneity issues stemming from reverse causality where traditional estimators would deliver inconsistent results. This is due to the emerging correlation between the unobserved effects and the lagged dependent variable. To circumvent this inconsistency, Arellano and Bond (1991) developed a consistent GMM estimator for linear dynamic panel data models. It removes the unobserved effects by taking the first difference and employs instruments to construct the moment conditions.

The Arellano-Bover/Blundell-Bond estimator represents an advancement of the Arellano-Bond estimator. Blundell and Bond (1998) identified a weakness in the Arellano-Bond estimator. This weakness pertains to the

lagged-level instruments, which can be weakened for two reasons: firstly, due to the persistence of the autoregressive process, and secondly, due to a large ratio of the variance of the unobserved effects to the variance of the idiosyncratic error. The system estimator developed by Blundell and Bond (1998) therefore not only employs the moment conditions of the lagged levels as instruments for the difference equation, but it also introduces additional moment conditions where the lagged differences are used as instruments for the level equation. However, these additional moment conditions hold only if the assumption that there is no correlation between the first difference of the first observation of the dependent variable and the unobserved effects at the panel level is satisfied. Additionally, this estimator assumes no autocorrelation among the idiosyncratic error terms (Blundell and Bond 1998).

To address the third problem of measurement errors, we rely on a comparably large number of dependent variables that are constructed in different ways and make use of different data inputs. In total, we believe that the employment of these different techniques helps us to overcome potential endogeneity that may affect our analyses.