Do Directors Drive Corporate Sustainability?

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December 13, 2020

Abstract

We use exogenous variation in the exposure of U.S. firms' directors to the staggered introduction of sustainability reforms in foreign countries to study the role of the board of directors in shaping firms' sustainability performance. Using a difference-in-differences design, we document that the board has a strong impact on U.S. firms' CSR performance. We find that CSR performance improvements are larger for firms with lower financial risk and firms in 'clean' industries. Firms exposed to sustainability shocks have greater subsequent firm performance and productivity.

Keywords: Environmental, Social, CSR, Sustainability, Directors, Boards, Shocks

JEL Classification: F30, G15, G34

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1. Introduction

Corporate sustainability policies have quickly moved into the spotlight in recent years. For example, in 2019, the Business Roundtable released a new Statement on the Purpose of the Corporation to promote and create value for all stakeholders—customers, employees, suppliers, communities, and shareholders.[1] Notably, this updated statement moves away from the previous paradigm of shareholder primacy. This emerging viewpoint is paralleled by renewed investor interests in corporate sustainability. For example, the 2020 annual letter by Larry Fink, titled "A Fundamental Reshaping of Finance," singles out climate change as the defining factor in companies' long-term prospects.

As a response to the new sustainability focus, companies have to carefully assess the costs and benefits of various strategic options. Many corporate sustainability initiatives require a vast upfront investment with benefits that may materialize in the distant future. The cost and benefits extend well beyond regulatory compliance and often involve hard to predict risks that involve international trends and competitive pressures. Given this long-term focus and the strategic nature of corporate sustainability, the board of directors can be instrumental in devising an efficient and effective corporate sustainability strategy. The optimal level of sustainability investment is unlikely to be a one-size-fits-all solution and involves extended collaboration with management to properly identify the materiality of different risks and opportunities.

At the same time, firms and management are increasingly facing direct outside pressure by various stakeholders to improve their sustainability practices. For example, institutional investors with a long-term investment focus push firms to increase their sustainability performance (e.g., Dyck, Lins, Roth, and Wagner (2019)) while often bypassing the boards' direct involvement.

[1] See "Business Roundtable Redefines the Purpose of a Corporation to Promote 'An Economy That Serves All Americans'," August 19, 2019, Press Release by the Business Roundtable.

Moreover, regulators directly influence firms' sustainability behavior by implementing stricter environmental regulations. Recently, firms have been held accountable for their sustainability policies by social and environmental campaigns.[2] Given the increasing outside pressures to directly influence firms' corporate sustainability, the exact role of the board in this process is uncertain.

Consistent with the uncertain role of the board of directors, a 2019 survey on corporate boards conducted by PwC reports that only 58% of the directors agree that companies should prioritize *all stakeholders* when making company decisions (PwC (2019)). In the same survey, most directors agree that investors put too much emphasis on environmental, social, and governance (ESG) issues and only half of the directors state that ESG is part of their enterprise risk management. The evidence in this survey suggests that ESG issues remain on the sidelines in many boardrooms.

Therefore, the extent to which the board of directors is taking a leadership role and is directly involved in shaping corporate sustainability is an open empirical question. However, this question has not been widely studied. In this paper, we provide evidence of how boards impact U.S. firms' corporate social responsibility (CSR) performance.[3]

Establishing a causal relationship between the board and the firm's sustainability performance is challenging. The composition of a firm's board (e.g., how sustainability-oriented the directors are) and a firm's CSR performance are jointly determined and often reflect the preferences of investors and management. Therefore, a clear identification strategy is needed to draw causal inferences about the extent to which the board of directors drives corporate

[2] See, for example, "Under pressure: campaigns that persuaded companies to change the world," by Marc Gunther, the Guardian, Feb 9, 2015.

[3] Throughout this paper we use the terms 'corporate sustainability' and 'corporate social responsibility (CSR)' interchangeably.

sustainability. Such evidence will be important for regulators, investors, and other stakeholders that are interested in promoting CSR policies.

To address the endogenous choice of corporate sustainability and board structure, we exploit exogenous variation from the staggered introduction of sustainability regulations and disclosure requirements in non-U.S. countries. We study the transmission of these sustainability rules to U.S. firms through U.S. directors' connections in the countries that experience such sustainability shocks—a U.S. firm is exposed to a foreign shock, and therefore treated, if one of its directors sits on a foreign firm's board that was affected by a sustainability regulatory change. Therefore, our identification strategy relies on a difference-in-differences design that uses the exposure to outside sustainability shocks as a driving variable behind the changes in CSR policies at U.S. firms. We compare the CSR performance of firms that are exposed to a sustainability shock through connected board members relative to unexposed firms, both before and after the sustainability shocks. This setup allows us to exploit exogenous variation and isolate the causal impact of the board of directors on the choice of CSR policies in U.S. firms.

Our econometric specification allows for the use of a strict set of fixed effects. We use firm fixed effects to exploit the time-series within-firm variation and include time fixed effects to control for the overall trend in improving CSR performance. In additional tests, we also ensure that our results are not driven by a firm's choice of directors by only using board members that had been on the board at least three years preceding the year of the sustainability shocks. We also perform tests where we use only the three years surrounding each shock experience, and ensure that our results are not driven by the presence of foreign connections only.

We use foreign sustainability shocks to identify the direct effect of the board of directors on U.S. companies' sustainability performance. We rely on the Carrots & Sticks Reports, a joint

effort by KPMG, GRI, UNEP, and the University of Stellenbosch, to compile a comprehensive list of changes in international sustainability regulations and reporting requirements at the country level. We then link these changes to U.S. firms using the BoardEx database to trace international board connections. Finally, we compute U.S. company-level CSR performance scores using the MSCI ESG KLD STATS and Thomson Reuters databases. The final sample of 2,860 U.S. firms observed over the 2001 to 2016 period consists of 24,424 firm-year observations with time-varying exposure to sustainability shocks and firm-level CSR performance scores.

Our results document a new channel to explain the adoption of corporate CSR policies—the transfer and implementation of such policies through the board of directors. We establish a direct link between sustainability policies and directors that serve on the board. The economic magnitude of this mechanism is sizeable. Our results suggest that a board that is exposed to a non-U.S. sustainability regulatory change increases a firm's CSR performance by 4.7%, which equals 18% of the typical variation in a firm's CSR performance. These changes are not limited to one area of sustainability but are present when we examine separately the sustainability scores related to environmental and social performance. Interestingly, given the increasing importance of climate change over the period we study, we find that the overall effect is stronger in environmental sustainability performance. However, we also find substantial improvements in social sustainability scores.

Our results are similar when we use an alternative CSR performance measure obtained from Thompson Reuters. The results also do not change when we redefine our treatment variable to account for cumulative shocks in cases where a firm is exposed to multiple shocks across different countries or multiple directors. And our findings obtain when we limit firms' event period to only the three years surrounding a sustainability shock.

Next, we examine the factors that facilitate the adoption of greater CSR policies. First, we document that firms' financial health plays a crucial role in the adoption of CSR policies. For example, firms that are close to default are less likely to improve their environmental scores. Moreover, firms that face greater R&D expenses and firms that have higher cash flow volatility, and therefore face greater cash flow uncertainty, invest less in improving their sustainability performance. These results highlight the importance of firms' financial health and cash flow volatility in promoting CSR policies.

We also find that environmental improvements are concentrated in 'clean' industries consistent with the notion that firms in clean industries have lower costs to improve their environmental commitments. Interestingly, we uncover some evidence of 'greenwashing' activities—firms in 'dirty' industries, such as the mineral extraction and processing industry, improve their social performance and not their environmental performance after a sustainability shock.

In the last part of our analysis, we document that being exposed to sustainability shocks through the board of directors is related to increases in firm profitability, sales, labor productivity, and capital productivity. This evidence corroborates a mechanism where boards with greater expertise weigh the costs and benefits and adopt CSR practices that positively impact firm performance. It also highlights the importance of CSR policies as a part of the board's long-term objectives to improve firm performance and mitigate risks.

Our paper contributes to the large literature on the role of the board of directors. This literature has historically focused on the role of the board in providing advice and expertise to the CEO, overseeing large corporate transactions, devising corporate strategies, and guiding CEO

appointment decisions.[4] This academic literature has largely found that the board of directors is instrumental in determining the governance practices of firms, and that board expertise is a major determinant of financial performance, especially in times of crisis or corporate restructuring events. We add to this literature by demonstrating that the board's influence is not limited to managing governance risks and setting executive compensation but also takes an active role in shaping corporate sustainability policies.

Our paper also directly contributes to the literature on the improvement of corporate sustainability. Previous papers have documented the role of investors, managers, and the legal environment. Dyck et al. (2019) study the role of institutional investors and their impact on firms' corporate social responsibility (see also, Kim, Wan, Wang, and Yang (2019) and Chen, Dong, and Lin (2020)). Dimson, Karakaş, and Li (2015) study private engagements by a large investor. Liang and Renneboog (2017) emphasize the role of country-level laws, while Ioannou and Serafeim (2012) highlight the role of national institutions. Dai, Liang, and Ng (2020) and Schiller (2018) show that CSR policies propagate along the supply chain. Cronqvist and Yu (2017) find that CEO characteristics impact the companies' CSR ratings. Finally, Ferrell, Liang, and Renneboog (2016) find that well-governed firms promote CSR. In sum, the literature has identified a host of internal and external factors that drive changes in firms' sustainability performance but has largely ignored the role of the board of directors.[5] In this paper, we use exogenous variation in board members' exposure to sustainability regulations to document the first-order effect of the board in improving firms' CSR performance.

[4] A literature survey on the various roles of the board of directors is beyond the scope of this paper. See, for example, Adams, Hermalin, and Weisbach (2010) for a discussion of the role of the board and a literature review.

[5] Krueger (2010) is an early study examining the relationship between the board of directors' characteristics and the occurrence of socially responsibility events. We are not aware of recent studies that focus on the role of the board in setting the sustainability policies in U.S. firms. Christensen, Hail, and Leuz (2018) provide a comprehensive literature review that discusses 380 papers on topics related to CSR and CSR reporting.

A growing literature studies the effects of CSR policies on firm valuation. Flammer (2015) finds that the adoption of 'close-call' CSR proposals lead to positive returns, and Lins, Servaes, and Tamayo (2017) find that the value of CSR is particularly high during the recent financial crisis. Shareholders also value CSR investments and punish low CSR funds (Hartzmark and Sussman (2019)). Krueger (2015) finds that the stock market reacts negatively to negative CSR news. CSR policies also play an important role in M&A deals (Deng, Kang, and Low (2013), are associated with a lower cost of capital (Chava (2014) and Dhaliwal, Li, Tsang, and Yang (2011)), and improve shareholder returns (Edmans (2011)). We complement this literature by showing causal evidence that the board of directors is actively involved in shaping firms' sustainability performance.

The literature has also documented the preferences of investors for greater corporate sustainability and the effect of sustainability on firm policies. In a survey about climate risk perceptions, Krueger, Sautner, and Starks (2020) find that institutional investors believe that climate risks have important financial implications and these risks have to be actively managed. Hong and Kostovetsky (2012) link the political behavior of mutual fund managers to their investment in socially irresponsible companies. Therefore, the changes in CSR policies we study have real implications for investors both because of the increasing preference of investors for greater CSR performance and the related value and performance implications. The board of directors is the fiduciary of investors and should be instrumental in setting firms' corporate sustainability policies. We provide evidence that this is indeed the case.

2. Empirical Setting

Studying the impact of the board of directors on firms' CSR policies is important because the board has the power and long-term focus to be a major driver of corporate change. Hence, if boards are instrumental in driving CSR policies, sustainability-oriented shareholders, regulators,

and other stakeholders should focus much of their attention on the board. However, quantifying the impact of the board on any firm outcome is challenging because of the endogenous matching between firms and directors and the effect of unobserved factors that can co-determine both the board of directors and firm outcomes. If we observe that directors' CSR attitudes are related to firms' future CSR performance levels, it is unclear whether this is because directors pressure firms to increase their CSR performance or whether the firm seeks to improve its CSR performance for unobservable reasons and therefore selects directors with greater CSR commitments. Thus, without a valid identification strategy, empirical correlations between the board and firms' CSR performance could be driven by endogenous matching or unobserved heterogeneity.

To overcome these empirical challenges and to establish a causal link between a firm's board of directors and its CSR commitments, we exploit a firm's directors' connections to non-U.S. firms. For each firm, we construct a mapping of U.S. firms' directors' positions on non-U.S. firms' boards. We then use the exposure of each U.S. firm to changes in foreign sustainability regulations and reporting requirements through its board connections to non-U.S. firms.

For example, suppose a director of a U.S. firm holds a director appointment in a firm domiciled in the U.K. In 2013, a regulation mandated that U.K. companies listed on the London Stock Exchange's main market will have to report their levels of greenhouse gas emissions in a standardized way in their annual reports.[6] This regulation 'shock' to environmental practices in the U.K. will increase the salience of environmental commitments experienced by directors on U.K. firms' boards, including the director that is concurrently sitting on the U.S. firm's board. The

[6] We use this regulation as one of the foreign (non-U.S.) originated sustainability shocks that drive sustainability policy changes in U.S. firms. See Jouvenot and Krueger (2020) for more details and evidence on the direct effect of this new regulation on domestic U.K. firms.

increased importance of environmental policies will be potentially transmitted and implemented in the U.S. firm through this director connection.

We also extend this exposure measure later in the paper to further account for the possibility that two different directors on a U.S. board have exposure to the same foreign shock or that another director in the same firm has exposure to alternative shocks in other foreign countries. In both scenarios, we expect that additional exposure to sustainability shocks will further strengthen the effect on corporate sustainability.

To examine whether directors drive firms' CSR performance, we use the following regression specification:

$$CSR_{i,t} = \alpha + \beta \times Sustainability\ Shock_{i,t-1} + \theta X_{i,t-1} + \gamma_i + \mu_t + \varepsilon_{i,t}, \qquad (1)$$

where $CSR_{i,t}$ is the sustainability performance of firm *i* at time *t*. $Sustainability\ Shock_{i,t-1}$ measures the exposure of directors of firm *i* to a shock to sustainability policies through a director connected to a foreign-shocked firm at time *t–1*. $X_{i,t-1}$ is a set of time-varying firm-level control variables described in Appendix A. We include a full set of firm (γ_i) and year (μ_t) fixed effects and allow for heteroscedastic error terms that are clustered at the firm level ($\varepsilon_{i,t}$).

How does this empirical strategy help us to tackle our identification challenges? Our main variable of interest ($Sustainability\ Shock_{i,t-1}$) is based on shocks to sustainability regulations and reporting requirements in non-U.S. countries. These shocks address the endogeneity concern of studying U.S. firms' sustainability changes as a function of board actions as they are unrelated to U.S. firms' future decisions on their CSR commitments. In other words, the identifying assumption behind our results is that foreign countries do not implement sustainability regulations with the intention to affect U.S. firms through connected board members. The regulations we study

are primarily focused on achieving domestic sustainability goals, rather than impacting U.S. firms. Moreover, the exact timing of these regulations is often dictated by political and societal pressures in the foreign country. Further, directors exposed to the shocks will gain valuable experience in the actual implementation and compliance with sustainability mandates. Prior work establishes director networks as a strong propagator of director practices on firm governance (Bouwman (2011)), executive pay (Engelberg, Gao, and Parsons (2013)), and M&A policies (Field and Mkrtchyan (2017)).

In sum, we rely on outside shocks to U.S. firms that at any given time only affect a fraction of the U.S. firms we study. These shocks allow us to exploit the causal effect of exposure to sustainability regulations and reporting requirements on U.S. firms' CSR policies.

The staggered adoption of exogenous foreign regulations allows for the inclusion of a strict set of fixed effects that mitigate problems due to unobserved heterogeneity. We include year fixed effects that allow us to control for overall time trends in CSR performance and mitigate confounding omitted effects (e.g., economic shocks) specific to the adoption of an individual regulation. We also include firm fixed effects in all models to absorb any time-invariant unobservable variation at the firm level.

A remaining concern is that some U.S. firms appoint directors with connections to foreign countries in anticipation of changes to these foreign countries' sustainability regulations. To rule out that such selection effects drive our results, we also present tests that rely only on directors with a minimum tenure of three years before the foreign sustainability shocks. Our results do not change.

A major advantage of our research approach is that it does not rely on the measurement of directors' CSR attitudes. We only require that the importance of CSR commitments becomes more

salient once the exposed board member gains valuable experience in the implementation of new sustainability regulations and disclosure requirements introduced in the foreign-connected country. In terms of economic significance, our test design might underestimate the total change in firms' CSR performance that is driven by the board of directors. Instead, we are focusing on one channel that can be empirically identified. Consequently, the results we uncover should be interpreted as a lower bound of the overall impact of directors on firms' CSR performance.

3. Data

In this section, we describe the sustainability shock measures, the metrics of firms' CSR performance, and provide summary statistics of our sample.

3.1. Measuring Firms' Exposure to Sustainability Shocks

We use the BoardEx database to build a detailed dataset of U.S. firms' board of directors and the U.S. firms' directors' board positions in non-U.S. firms. BoardEx has been widely used in studies of board composition and board connections (e.g., Fracassi and Tate (2012), Engelberg, Gao, and Parsons (2013), and Bouwman (2011)). It provides detailed data on directors such as a director's appointments, characteristics, and careers. Important for our study, and unlike the IRRC directors' database, the BoardEx database covers a wide cross-section of public firms across the world and allows us to track board appointments a director has at firms outside of the U.S.[7] That is, for each U.S. firm and year, we know the composition of the board as well as on which outside non-U.S. boards the firm's directors serve. The BoardEx database also provides the board member types, which allows us to further study if our effects are transmitted when we focus on non-executive directors only.

[7] We use director experiences with public and private foreign boards because both types of experiences expose the director to the foreign rule and regulation.

We obtain data on major changes to countries' sustainability regulations and reporting requirements from the Carrot & Sticks reports. These reports are a joint effort by KPMG, GRI, UNEP, and the University of Stellenbosch Business School's Centre for Corporate Governance to compile a list of sustainability regulations and reporting requirements worldwide. Schiller (2018) uses international regulatory changes described in the Carrot & Sticks reports to identify the role of supply chain networks in transmitting CSR shocks.

We use all mandatory sustainability rules published in the Carrot & Sticks reports that apply to all companies, excluding non-binding rules and suggestions. We also exclude rules that only apply to a subset of firms (by industry or geography) or state-owned firms. We define a regulatory shock as the first year when the rule was passed.[8] Since we are interested in a firm's CSR performance, we only use mandatory regulation and reporting changes concerning the sustainability dimensions, excluding any regulations related to governance rules. Appendix B reports details on the sustainability regulation and reporting changes across countries we use in our study.

We combine the BoardEx director data with the sustainability regulation data to create sustainability shock exposures at the firm level for all U.S. firms. The exposure variable captures the spillover from directors who serve on boards in affected foreign countries to the U.S. companies we study.[9] Figure 1 shows the fraction of U.S. sample firms that are exposed to a sustainability shock in a particular year over the 2000-2016 period. Some firms are exposed to multiple shocks over the period we study. We observe sustainability shock exposures each year

[8] Alternatively, for robustness, we use the year when the rule became effective and find similar results.

[9] Chen, Hung, and Wang (2018) show that environmental regulations in China that mandate disclosure of corporate social responsibility have a first order effect on the affected firms' performance and their environmental practices. Gibbons (2020) shows that international sustainability regulations increase the CSR performance of the directly affected foreign companies.

after 2000, with a general increase over time. Overall, the data exhibits significant variation in U.S. firms' exposure to foreign sustainability shocks with considerable variation both over time and across firms.

Our main shock variable is an indicator variable that switches to one for a U.S. firm with a director who serves on the board of a firm in a non-U.S. country that experienced a sustainability regulation or reporting change. This indicator variable is equal to one in the year of the shock and all subsequent years. Table 1 reports summary statistics of the variables. The sustainability shock indicator variable has an average value of 0.195, implying that on average 20% of the firms are treated in any year. Of course, due to the staggered introduction of sustainability regulations, the treatment is low at the beginning of our sample period, with a starting value of 6.5% in 2001 and an increase to 41.8% in 2016.[10]

In our main shock measures, we consider a firm exposed to a sustainability shock as soon as one of the firm's directors has experienced such a shock in a foreign-connected firm. However, a firm can be exposed repeatedly through a director's exposure to different rules and countries, and through multiple directors being exposed to the same country shock. These shock intensity measures increase with each additional connected-country regulatory change or increase with each director's experience with a foreign country regulatory shock. Therefore, an alternative exposure measure will be larger when measured by the total number of non-U.S. countries that expose a board to sustainability shocks or when further multiplied by the number of directors with such sustainability shock experiences. These are count variables that range from zero to 12 for the connected-country intensity variable and zero to 26 for the connected-director intensity variable.

[10] In additional tests, we address the issue that a firm might have unbalanced pre-treatment or post-treatment periods. In these tests we restrict our attention just to the three years surrounding the first time a firm was exposed to a sustainability shock.

Table 1 reports summary statistics for these two alternative measures. As expected, the average number of shocks a firm faces when we account for the possibility to be exposed to a shock through multiple countries is higher at 0.341 and increases slightly to 0.392 when we also allow each director-country experience as a separate shock transmission.

3.2. CSR Performance Data

We obtain data on firms' CSR performance from the MSCI ESG KLD STATS database (hereafter MSCI KLD). MSCI KLD tracks many U.S. firms with consistent coverage starting in 2001. For our analysis, we use data from 2001 through the end of 2016, the last year of available data. One of the advantages of using data from MSCI KLD is that the coverage of U.S. firms is substantially greater and coverage is available over a longer period compared to other ESG databases (e.g., Thomson Reuters, Bloomberg, and Sustainalytics). The MSCI KLD database has been used in many recent studies.[11]

MSCI KLD reports a set of positive and negative CSR performance indicator variables for each firm. For firms' environmental commitments, MSCI KLD reports between 14 and 18 indicator variables (depending on the reporting year). These usually consist of six to eight positive performance indicators and eight to ten negative performance indicators. For firms' social commitments, MSCI KLD reports indicators for five different subcategories: Community, Diversity, Employee Relations, Human Rights, and Products.

MSCI KLD does not provide proprietary company level weighted CSR scores that we could use for our tests. Instead, MSCI KLD reports a set of positive and negative sustainability performance indicator variables that document a company's sustainability performance. To

[11] See, for example, Hong and Kostovetsky (2012), Deng, Kang, and Low (2013), Chen, Dong, and Lin (2020), Di Guili and Kostovetsky (2014), Krueger (2015), Cronqvist and Yu (2017), and Lins, Servaes, and Tamayo (2017).

aggregate these indicators at the company-year level, we follow the approach of Cronqvist and Yu (2017). To that end, based on the indicator variables, we construct firm-level scores to measure firms' overall CSR performance. First, for each firm and year, we calculate the sum of positive indicators and subtract the sum of negative indicators (each indicator variable is equally weighted). Second, to convert the scores to a positive scale, we add the absolute value of the minimum score so that the lowest score is equal to zero. As discussed in Cronqvist and Yu (2017), this allows for an easier interpretation of the economic magnitudes of the estimated effects because each coefficient can be interpreted as an increase in the overall sustainability performance of each firm while preserving the relative importance of the positive (strengths) and negative (weaknesses) sustainability indicators.[12] The resulting overall CSR score ranges from zero to 27, with greater scores indicating better CSR performance. A one-unit increase in this score is equivalent to having one more positive sustainability performance indicator or one less negative sustainability indicator.[13]

We also construct separate scores to measure firms' environmental sustainability performance. For these scores, we combine a firm's answers to all questions in the Environmental category. More specifically, we calculate the sum of all positive environmental indicator variables and subtract the sum of all negative environmental indicators. We again normalize this score to have a minimum of zero by adding the minimum value of the difference between positive and negative indicators. The overall environmental score ranges from zero to 11.

[12] For robustness, using the MSCI KLD data, we calculate standardized scores that range between -1 and 1. These standardized scores are calculated as the sum of positive sustainability performance indicators minus the sum of negative sustainability performance indicators divided by the number of indicators reported. Using these standardized scores yields statistically and quantitatively similar results.
[13] Appendix A describes all variables and data sources.

To measure a firms' social sustainability performance, we combine a firm's answers for the five social categories Community, Diversity, Employee, Human Rights, and Products. Following the same approach as for the environmental scores, we sum positive indicators, subtract negative indicators, and normalize the score to have a minimum of zero. The overall social score ranges from zero to 24. Similarly, we calculate social subcategory scores for each of the five social categories.

Table 1 reports the summary statistics of the CSR scores. The overall CSR score has a mean of 9.1 with a standard deviation of 2.3. The scores that focus only on environmental and only on social issues have a mean of 5.1 and 10.0, respectively, again with a sizable variation of 0.8 and 1.9. These scores are in line with the reported average overall CSR score of 10.3 in Cronqvist and Yu (2017). Further, the average social subcategory scores range between 2.1 (Community) and 4.1 (Employee).

For robustness, we use CSR scores from the Thomson Reuters ESG Database. Like MSCI KLD, Thomson Reuters ESG uses a variety of sustainability indicators to measure a firm's CSR performance. We use their proprietary-weighted aggregate environmental and social scores and calculate an overall CSR score as the average of the environmental and social score. These rank-based scores range from zero to 100 and measure the CSR performance relative to all other companies within an industry and year. The overall CSR score has an average of 49 with a standard deviation of 18. The average sample value of the environmental score is 47 and the average social score is 52, with a sizeable standard deviation of 22 and 18, respectively.[14] The Thomson Reuters ESG database, however, tracks a much smaller cross-section of U.S. firms over a shorter time.

[14] The Thomson Reuters ESG database does not provide an overall CSR score.

Therefore, we use this smaller sample only to provide corroborative evidence for the overall effects we document.

3.3. Sample Characteristics

In our analyses, we control for time-variant firm characteristics that may affect firms' CSR performance directly. We obtain financial statements, stock market valuation, and 13F institutional holdings data from Compustat, CRSP, and Thompson Reuters, respectively. In all our tests we control for firm size (measured as the log of total assets), cash holdings (measured as cash and cash equivalents divided by total assets), market-to-book ratio (measured as the market value of equity divided by book value of equity), profitability (measured as operating income before depreciation to total assets), tangibility (measured as PP&E divided by total assets), R&D intensity (measured as R&D expenses divided by total assets), financial leverage (measured as total debt divided by total assets), stock return (one-year stock return over the firm's fiscal year), and institutional ownership (measured as the fraction of shares held by institutional owners as a percentage of the company equity).[15]

At the board level, we use data from BoardEx to control for board and governance characteristics: the firm's board size (log of number of directors on the board), board tenure (log of average director tenure), board independence (percentage of independent directors), CEO-Chairman duality (indicator that equals one if the CEO is the chairman of the board, zero otherwise), and CEO tenure (log of one plus CEO tenure). Our final sample consists of 24,424 firm-year observations and covers 2,860 U.S. firms during the 2001 to 2016 period. This sample

[15] Recent research highlights the importance of institutional owners on firms' CSR performance (see, e.g., Dyck et al. (2019)). At the same time, He, Kahraman, and Lowry (2020) document relatively low support by institutional investors for shareholder proposals related to CSR issues in U.S. firms.

is considerably smaller at 12,571 firm-year observations when we rely on the Thompson Reuters sustainability scores.

Table 1 reports summary statistics of firm characteristics and performance measures for our full sample. We study large and middle-sized U.S. firms with average total assets of $13 billion. We are unable to study small firms because we require both BoardEx and sustainability data and these databases have only limited coverage of small U.S. firms. However, our sample is representative of the samples in most studies of the U.S. public market that focus on corporate sustainability or governance performance.

The firms have significant cash holdings of 17.5% of total assets and have high profitability and stock returns throughout the study. On average, the sample firms have book leverage of 20% and a market-to-book ratio of 3.6. In terms of board characteristics, our firms are also typical of the U.S. population of large firms with significant institutional ownership of 72%, a board size of nine directors, average board tenure of eight years, 76% of the directors are independent, and average CEO tenure of close to 10 years with 64% of the CEOs are also chairmen of the board. We control for these firm and governance characteristics in all our specifications.

4. Do Directors Drive Firms' CSR Performance

We next test our main hypothesis that the board of directors is instrumental in driving firms' CSR performance. We also provide robustness checks to our main results.

4.1. Main Result

Figure 2 reports the unconditional evidence. In the top panel of the figure, we report the average overall CSR scores of firms that are exposed to a shock relative to the average score of all unexposed firms in the same year. We plot the CSR scores in even time, where $t = 0$ is the first

year after a sustainability shock. The figure shows a clear pattern of an increase in CSR scores for the treated firms after they were exposed to a sustainability shock. We also observe a slight pre-event upward trend that is consistent with an increase in CSR scores over time in the U.S. This common pre-trend is effectively a parallel trend before the shock exposures as it is shared by both the treated firms and the sample of control firms. The real difference between the two groups becomes bigger only after a firm encounters a shock. We observe similar patterns in the next two panels of Figure 2, where we focus separately on environmental and social sustainability scores. Overall, the effects of the shocks are more pronounces in environmental compared to social scores. Next, we turn to regression evidence based on Eq. 1, in which we control for firm characteristics and unobserved heterogeneity across firms.

Table 2 presents the results of our main empirical tests of whether the board drives firms' CSR performance. In the first specification in column 1, we regress the company's overall CSR score on an indicator variable that equals one if the company was exposed to a sustainability shock in the preceding year. This specification, as described in Eq. 1, implements a difference-in-differences approach that compares 'shocked' (treated) companies to unaffected (control) companies both in the pre- and post-shock period. The shocks we use are staggered because they depend on the differential timing of the sustainability regulations in the connected countries and whether a company is exposed to such shocks. We control for firm and year fixed effects to allow for overall time trends and unobservable company-level fixed heterogeneity.

We find that board exposure to sustainability regulation and reporting requirement changes in a foreign country leads to a 0.446 unit increase in a firm's overall CSR performance. The economic magnitude of this result is sizable—it is equivalent to a 4.9% increase in the overall CSR score after a shock (calculated as the coefficient of 0.446 divided by the average CSR score of

9.14). This change is also meaningful relative to the variability in firms' CSR scores—it accounts for 19.1% of the standard deviation of firms' CSR scores (calculated as the coefficient of 0.446 divided by the standard deviation of CSR scores of 2.34).

Our model includes a variety of firm and governance characteristics. These time-varying characteristics control for contemporaneous changes in firm size, performance, investment, financing, ownership, and board and governance features. The coefficients on the control variables should be interpreted as conditional on the firm and year fixed effects structure. The one highly significant control variable in the first column is tangibility, suggesting that increases in firms' tangible assets is positively related to overall CSR scores. Overall, however, we do not find strong and consistent correlations between the CSR scores and firm and governance characteristics. Because these effects are not causal, they should be interpreted with caution.

Columns 2 and 3 of Table 2 present separate regression results for firms' environmental and social sustainability scores, respectively. In column 2, the dependent variable is the environmental sustainability score, and the results show that a shock to sustainability rules in a connected country results in a sizable and statistically significant increase in firms' environmental performance. Economically, if a firm is exposed to a shock, the firm's environmental score increases by 5.2%. This change is approximately equal to 31.8% of the standard deviation of firms' environmental performance scores. In column 3, we repeat our test exclusively for social sustainability scores and find similar, albeit somewhat weaker effects. The implied increase in social scores is 1.8%, which represents 9.4% of the standard deviation of firms' social performance scores.

Table 3 presents further evidence about the effect of sustainability shocks on social sustainability performance. We break down the social sustainability performance into the

subcategories as reported in the MSCI KLD database. The table demonstrates that the effects are concentrated in improvements in the companies' employee and product scores and are weaker and statistically insignificant in community, human rights, and diversity scores. A likely explanation is that employee policies and product safety and sustainability are more transferable sustainability goals that are largely homogeneous across countries and firms, while community scores, for example, are much more dependent on local norms and practices.

Overall, the results show that the board drives firms' CSR performance. The economic impact of the board on firms' sustainability is economically significant. While the effects are present in firms' environmental and social scores, the results are stronger for environmental performance.

4.2. Director Appointments and International Boards

Next, we consider the possibility that some of our results are driven by recent director appointments and not by the directors that were in place before the sustainability shocks we study. The threat to identification comes from the possibility that firms seeking to improve their CSR performance are strategically appointing directors with experience in recent or upcoming CSR regulation changes abroad. In such a setting, it is likely the firm would have moved towards greater sustainability even without a sustainability shock. Therefore, it is important to test if our results hold when we focus only on the directors that are in place before the experienced sustainability shock.

To that end, in Table 4, we modify our measure of shock exposure by relying solely on directors that had been on the board for a minimum of three years preceding the year of the shock. These tests ignore any recent director appointments and therefore eliminate the possibility that the results are driven by the firm selectively appointing directors with non-U.S. board seats for their

expertise in current or forthcoming sustainability rule changes. We find that our results are qualitatively similar when we rely only on the part of the variation coming from directors with a minimum of three years of tenure before the shock happened. If anything, the results for the overall and environmental sustainability scores are economically larger, potentially reflecting the additional importance of the knowledge transfer through established and more experienced directors that are in a better position to shape the companies' policies.

In additional tests, we further examine whether the changes are solely driven by directors that are executives in the firm (e.g., the CEO or CFO) as these directors may have greater power to bring about change to company policies. However, in our sample, this is unlikely the case as we find a small fraction of executive directors is connected to foreign firms. While 26.2% of the firms are linked to a foreign firm through a non-executive director, only 3.1% of the firms have a link through executive directors. This is also consistent with the notion that executives will find it too time-consuming to commit to foreign boards. Formal tests in Appendix Table C1 show that it is indeed non-executive directors that drive firms' CSR performance. When excluding the small number of executive directors, the coefficient estimates are virtually the same as in our baseline regressions of Table 2.

In our next set of tests, we go a step further and test whether a company that has directors with non-U.S. board seats is more likely to implement CSR changes. If companies' foreign exposure leads to similar increases in firms' CSR performance even in the absence of a sustainability shock, then the regulatory shock exposures might play a secondary role. In these tests, our main variable of interest is an indicator variable equal to one if the firm has a board member that serves on a foreign firm's board (i.e., is connected to a foreign firm), and zero otherwise. Since we include firm fixed effects in these tests, we identify the effect of adding or

dropping a director with foreign connections relative to the firm's average CSR performance. The variation in foreign connections is sizable—over our sample period, 41% of the firms change their foreign connection status.

The results in Table 5 show that the relation between the foreign connected board members and firms' CSR scores is economically small and statistically insignificant. If anything, we find that foreign connections are slightly positively correlated with social scores but have a zero correlation with environmental scores. Thus, our previous findings are not driven by simply having foreign connections or an international board.

4.3. Governance, Sustainability Shock Measures, and CSR Measures

In this section we provide results from additional robustness tests. First, we explore an alternative channel for our findings. It may be possible that the sustainability shocks we study directly affect U.S. firms' governance, and that in turn it is better governance (and not directors) that drives firms' sustainability performance. If this alternative channel is driving our results, the sustainability shocks must have a direct effect on U.S. firms' governance. Therefore, in Table 6, we test whether the sustainability shocks drive firms' governance directly, and we do not find such evidence. All coefficient estimates on the sustainability shock variables are statistically insignificant, and the economic effects on the governance characteristics are minimal. Thus, these results confirm that the sustainability shocks we study do not drive firms' governance and thus it is unlikely that in our setting it is governance that drives firm's CSR performance.

In our tests so far, we use an indicator variable to measure firms' exposure to a foreign sustainability shock. An alternative way to measure a firm's shock exposure is to use measures that consider the intensity of the shock exposure. To that end, we calculate shock measures that increase with each different country shock to which a company is exposed. For example, a firm

that is exposed through its board to an environmental shock in Israel in 2009 and another environmental regulation in Norway in 2013 will have a shock value of zero before 2009, a value of one between 2009 and 2012, and a value of two in 2013 and all subsequent years. Using this shock intensity measure, in Panel A of Appendix Table C2, we confirm our previous results that the board impacts firms' CSR performance through experienced sustainability shocks in foreign countries.

Our results are also consistent when we rely on a measure that instead aggregates the sustainability shock exposures at the individual director level. With this measure, we further increase the shock count by the number of directors that link a company to a foreign country with sustainability shocks. The idea is that if two directors have experience with a foreign country then the company receives a higher exposure to new sustainability rules and regulations. Consider the example of a firm that is exposed through its board to an environmental shock in Israel in 2009 and another environmental regulation in Norway in 2013. Let us further assume that the firm has two directors that are connected to Israel and one director that is connected to Norway. This alternative measure will have a value of zero before 2009, a value of two between 2009 and 2012, and a value of three in 2013 and all subsequent years. Panel B of Appendix Table C2 confirms our results when using this second alternative shock intensity measure.

In Table C3, we present evidence from a set of models that uses just the three years surrounding the first sustainability shock that each company experiences. This creates a more balanced panel of observations that are not overweighting the firms' pre or post-shock years. The results we obtain are similar. The economic magnitudes are smaller, which is consistent with the evidence in Figure 2 that the effect of the shock is increasing over time as the firms have more time to implement changes.

Next, we test if our results hold with alternative measures of firms' CSR performance. First, we consider an alternative approach to measure firms' CSR performance using data from the MSCI KLD database (see, e.g., Lins, Servaes, and Tamayo (2017)). Instead of relying on a scaled sum of each firm's positive and negative sustainability performance indicator variables, we sum up all positive and subtract all negative indicators and divide this sum by the total number of indicators reported. This measure ranges between -1 and 1. The results are reported in Appendix Table C4 and are consistent in terms of economical and statistical significance with the effects documented in our baseline tests in Table 2.

In Table C5, we measure a firms' CSR performance using a different data source, the Thompson Reuters ESG database. The Thomson Reuters scores are constructed based on 124 indicators in the categories Resource Use, Emissions, Innovation, Workforce, Human Rights, Community, and Product Responsibility. The measures are calculated as percentile scores that measure a firm's sustainability performance relative to its industry peers in a given year. Using the Thomson Reuters sustainability scores, our results confirm that boards, through the exposure to foreign sustainability shocks, impact firms' CSR performance.

5. Heterogeneity in the Improvements of Firms' Sustainability Performance

We document an increase in firms' CSR performance driven by the board of directors' exposure to sustainability shocks in connected countries. However, boards must consider key firm characteristics when devising an optimal CSR strategy. Such policies will depend on a firm's financial position and its operational environment. In our next tests, we rely on interactions between the sustainability shock exposure variables and measures of financial strength and industry affiliation. Because we use exogenous sustainability shocks, the interaction terms will

pick up the differential impact of the shocks as a function of various firm characteristics, thus highlighting what characteristics increase or reduce directors' impacts on firms' sustainability.

First, we consider the effects of financial strength. Recent research has shown that financial constraints and closeness to default lead to worse environmental outcomes. For example, Xu and Kim (2020) and Goetz (2019) find that financial constraints increase firms' toxic emissions, highlighting the tradeoff between environmental costs and increased costs of litigation and non-compliance. Similarly, Bartram, Hou, and Kim (2019) document that financially constrained firms shift production away from California once it introduced a carbon cap-and-trade rule. Finally, Cohn and Deryugina (2018) find a direct and negative link between firms' cash flows and the number of environmental spills firms experience.[16] All of these papers suggest that firms financial strength play a prominent role in the firms' decision about the optimal level of environmental policy.

To test for the differential effect of financial strength on firms' sustainability performance, we include an interaction term between our shock variable and measures of firms' distress probability, investment in intangible assets, and cash flow volatility. Our empirical specification is equivalent to a triple difference-in-difference-in-differences design where we compare the differential effect of the shocks on treated (exposed to a shock) vs. control firms, in firms with financial constraints vs. firms without such strong constraints, before and after the shock. Because all our measures increase in firms' financial needs, a negative coefficient estimate on the interaction term implies that the effects of sustainability shocks experienced by directors on firms' CSR performance are smaller when firms face financial challenges. We expect that companies that are in a weaker financial position will have less flexibility to react to sustainability shocks.

[16] Additionally, Shive and Forster (2020) and Akey and Appel (2020) show that firms' environmental policies are directly related to the company financial incentives.

Consistent with this notion, the results in Table 7 show that firms' financial strengths are an important determinant of boards' impact on firms' CSR policies. In Panel A of Table 7, we use a measure of the probability of default based on Merton's distance to default model (Bharath and Shumway (2008)). Consistent with the high costs associated with environmental changes, we find that firms that face a higher probability of default are particularly unlikely to improve their environmental sustainability performance. This might be also a sign of debtholder-shareholder conflicts, where shareholders do not want to implement a beneficial yet costly policy if large parts of the benefits will go to the debtholders. We do not see this interaction effect in the case of social sustainability performance.

Similarly, in Panel B of Table 7, we find that companies with high R&D expenses are less likely to implement environmental changes. To the extent that firms with high R&D expenses face more financial uncertainty and have greater precautionary savings motives, these results again imply that firms with lower financial flexibility are less likely to implement sustainability changes. Once again, the effects are especially pronounced for environmental sustainability performance changes.

Finally, Panel C of Table 7 considers a more direct measure of the availability of internal funds: the volatility of cash flows. A firm with volatile cash flows is more likely to need external funding, and therefore faces financial constraints more often. Again, we find that firms with high cash flow volatility have lower increases in their overall and their environmental sustainability scores after a shock. All three measures of financial strength suggest that financial considerations play an important role in directors' driving firms' sustainability performance.

Next, we consider firms' operational environment: we focus on the type of industry in which the firm operates. We follow Dyck, Lins, Roth, Towner, and Wagner (2020) and use the

SASB industry classifications to measure whether an industry is considered 'dirty' or 'clean'.[17] We then use an interaction term between the sustainability shock and an indicator variable of whether a firm belongs to a clean or dirty industry. We expect that firms that operate in industries with substantial environmental impacts that cannot be mitigated at a low cost will be more reluctant to change their CSR policies.

The results in column 1 of Table 8 suggest that firms in dirty industries exhibit a smaller increase in their overall CSR scores. The interaction term is negative but statistically insignificant. The overall result, however, masks important heterogeneity in the effect. Column 2 of Table 7 shows that the improvement in firms' environmental performance is concentrated in firms from clean industries, and there is no improvement in environmental scores for firms in dirty industries. The differential effect of sustainability shocks between firms from dirty and clean industries is highly statistically significant. This is consistent with the notion that any improvements in environmental practices in dirty industries are likely very costly and difficult to implement. Interestingly, we find the exact opposite pattern in changes in social sustainability scores. Firms in dirty industries significantly improve their social performance upon a sustainability shock (*p*-value < 5%). This result is consistent with the incentives of companies to use their CSR scores to manage their external reputation after negative events (Akey, Lewellen, and Liskovich (2020)).

Overall, the results in Tables 7 and 8 suggest that the boards' ability to shape firms' sustainability performance is impacted by firms' financial strengths and operational constraints.

[17] Dyck et al. (2020) classify industries using the 11 sub-categories from the SASB sections about environmental performance (Environment and Business Model and Innovation). A score is calculated as 2 points if classified as "material for more than 50% of industries in the sector", 1 point if "material for less than 50% of industries", and 0 points if "issue not likely to be material for any industries". These scores suggest that the sectors that are most material ('dirty') are SIC Divisions A (Agriculture, Forestry, And Fishing), B (Mining), and I (Services). SIC Divisions C (Construction), D (Manufacturing), E (Transportation), F (Wholesale Trade), G (Retail Trade), and H (Finance) are considered as 'clean' industries.

6. Sustainability Shocks and Firms' Operating Performance and Productivity

In devising a corporate sustainability strategy, the board needs to assess the costs and benefits of investing in greater CSR commitments, and thus, must decide how much (or little) to invest in the firm's sustainability. Therefore, the board's effect on the firm's CSR policies may have a direct impact on the firm's financial performance. Directors who have gained direct experience with the implementation of CSR policies abroad would also have a better estimate of the expected costs and benefits, thus reducing the inherent uncertainty of CSR investments. To that end, we examine the link between sustainability shock exposures and various measures of operating performance and productivity. In doing so, we are testing the hypothesis that knowledge about CSR policies and expertise in the implementation of such policies will improve firm performance. Any results may capture a direct effect of CSR improvements on firm performance, but would also be consistent with an indirect effect of achieving CSR performance levels in a more cost-efficient way.

In Table 9 we regress measures of operating performance and firm productivity on the sustainability shock variable. The results in columns 1 and 2 suggest that sustainability shocks are related to an increase in firms' profitability and sales. We estimate an increase of 0.6% in profitability, which is a 5.6% higher profitability relative to the average firm profitability of 10.6% over the period we study. Similarly, we find an economically meaningful increase in sales of 4.5% after exposure to environmental shocks.

In columns 3 and 4 of Table 9, we test for the potential effects on firm productivity (measured as the logarithm of the ratio of sale to the number of employees) and firm asset utilization (measured as the logarithm of the ratio of sales to PP&E). We find that the increased profitability after a sustainability shock also maps into significantly higher productivity and better

utilization of companies' tangible assets. This result suggests that improvements in firms' CSR practices involve a more efficient use of resources.

In sum, these results show that the board's decisions are consistent with a trade-off of the costs and benefits of CSR investments. The net effect is an increase in corporate sustainability performance alongside an increase in firms' operating performance and productivity.

7. Conclusions

We show evidence of the crucial role the board of directors plays in setting companies' corporate sustainability. The strength of our analysis lies in the novel empirical design—we use exogenous variation in international sustainability regulation and reporting requirements that allow us to draw causal inferences about the important role the board plays in improving firms' CSR performance. Our main result shows that the board of directors plays a crucial role in shaping corporate sustainability policies. The results also highlight where the board of directors matters the most. The effects we find are stronger for environmental policies, implying that corporate boards will be instrumental in tackling the challenges coming with climate change and the rapid increase in the world population.

We further show that the board of directors' role is limited in the presence of financial and operational constraints. These results should not be taken as a verdict of the boards inefficiency in certain situations, they however suggest the crucial role of a cost-benefit analysis in shaping firms' optimal sustainability policies. Finally, we document that exposure to positive sustainability regulatory shocks is associated with improvements in firm operating performance and productivity.

Our results are important for investors, regulators, and other stakeholders that need to understand the role of the board of directors in shaping corporate sustainability performance.

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Figure 1
Distribution of Sustainability Shocks Over Time

This figure shows the fraction of U.S. sample firms that are exposed to a sustainability shock in a particular year over the 2000-2016 period. A firm is exposed to a shock if a board member serves on the board of a firm domiciled in a foreign country that implements a new sustainability regulation or disclosure requirement. The sustainability shocks are based on sustainability reporting and regulatory requirements as shown in Appendix B.

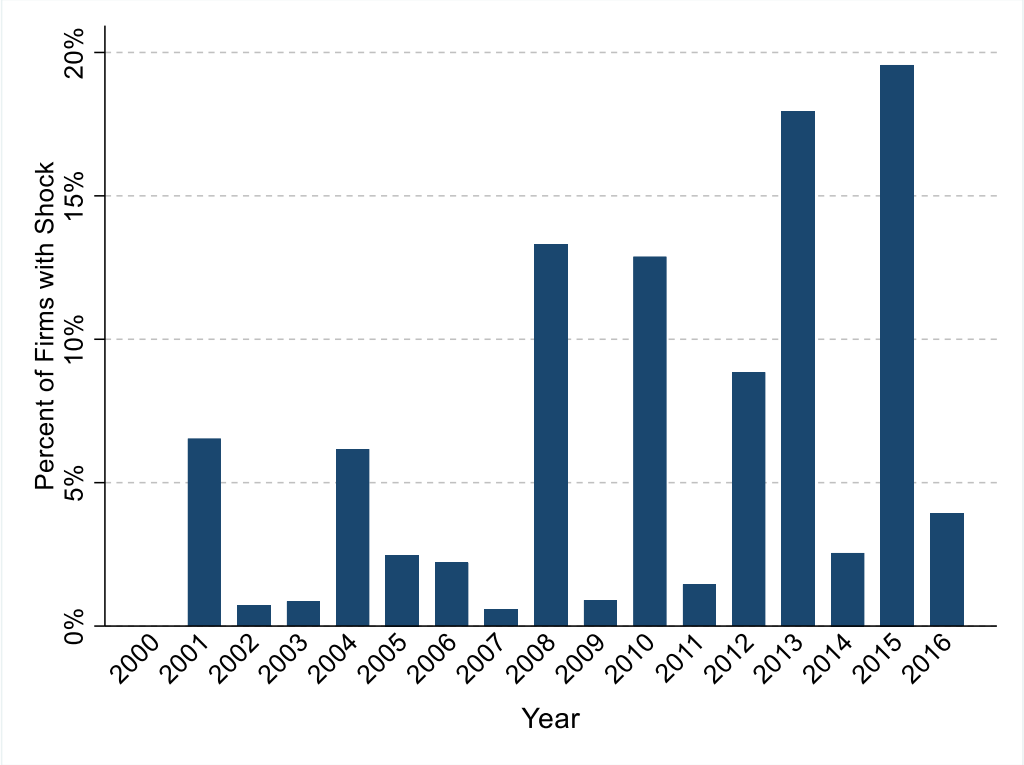

Figure 2
Firms' CSR Performance in Event Time

This figure shows the average overall CSR scores, the environmental sustainability scores, and the social sustainability scores for the sample firms that are exposed to a sustainability shock over the 2001-2016 period (treated firms) and unexposed control firms in event time. Event-year zero is the first year that a treated firm was exposed to a sustainability shock through a director who was serving on the board of a foreign firm that was exposed to a new sustainability regulation or reporting requirement. For each treated firm, the value of the control firms is the average CSR score of all untreated firms in the same calendar year. The CSR scores are calculated using data from the MSCI KLD database. The sustainability shock measure is calculated based on sustainability reporting and regulatory requirements as shown in Appendix B. All variables are described in Appendix A The sample period is 2001-2016.

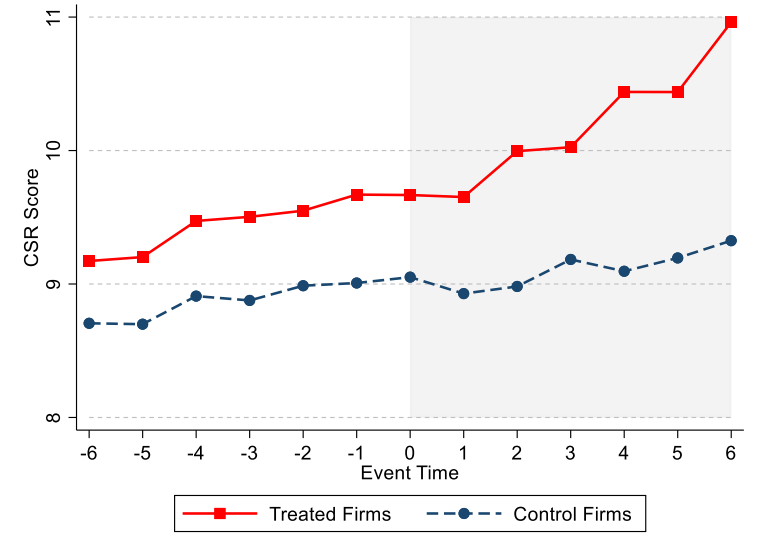

Figure 2A: Overall CSR Scores

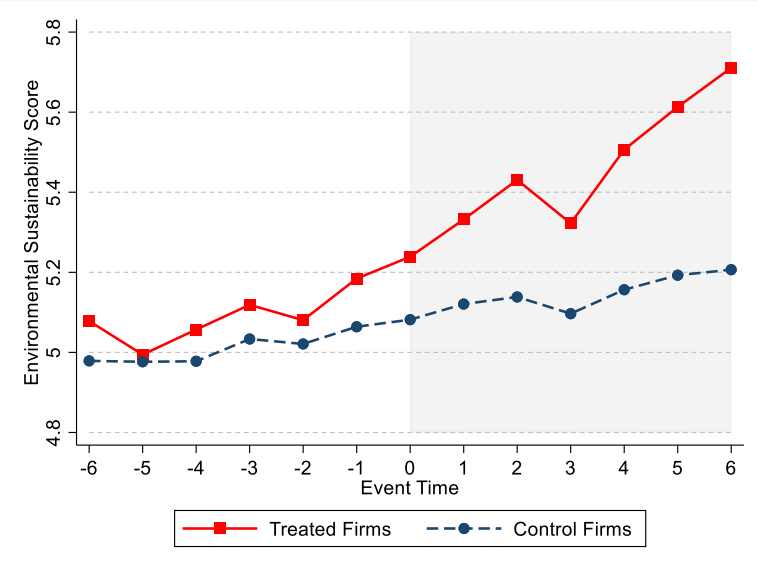

Figure 2B: Environmental Scores

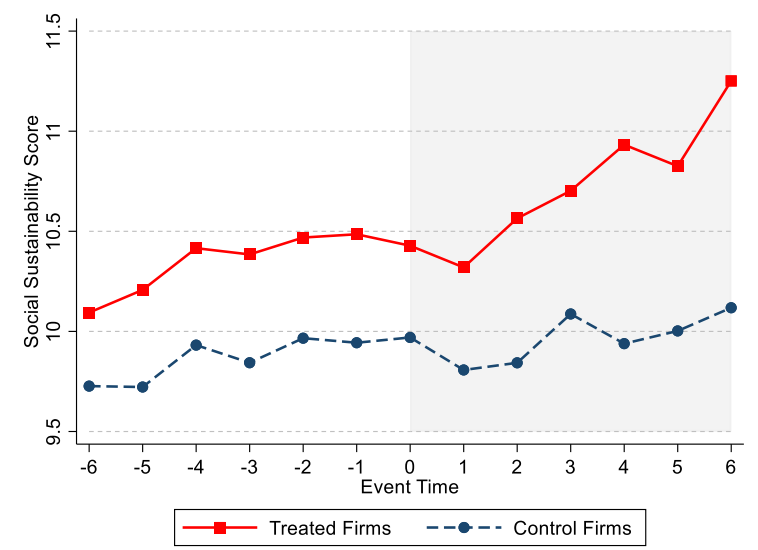

Figure 2C: Social Scores

Table 1
Summary Statistics

This table provides summary statistics. The sample consists of 24,424 firm-year observations across 2,860 U.S. firms over the 2001-2016 period. Thomson Reuters Scores are available for a smaller subsample of 12,571 firm-year observations across 1,978 U.S. firms. Variable descriptions and data sources are provided in Appendix A. The sustainability shock measures are calculated based on sustainability reporting and regulatory requirements as shown in Appendix B. All variables are winsorized at the 1st and 99th percentiles.

	Mean	Median	SD
A. Sustainability Shock Measures			
Sustainability Shock	0.195	0.000	0.396
Sustainability Shock (Min. 3 Years Tenure)	0.144	0.000	0.351
Sustainability Shock Intensity (Country)	0.341	0.000	0.869
Sustainability Shock Intensity (Director)	0.392	0.000	1.118
B. CSR Scores			
MSCI KLD Scores			
Overall	9.14	9.00	2.34
Environmental	5.11	5.00	0.83
Social	10.03	10.00	1.94
Employee	4.09	4.00	1.02
Product	3.90	4.00	0.58
Human Rights	2.98	3.00	0.25
Community	2.07	2.00	0.46
Diversity	3.00	3.00	1.25
Thomson Reuters Scores			
Overall	49.01	44.94	18.40
Environmental	46.43	41.86	21.82
Social	51.58	49.38	18.04
C. Control Variables			
Total Assets	13,064	1,558	82,314
Cash	0.175	0.094	0.094
Market-to-book	3.645	2.180	7.486
Profitability	0.106	0.112	0.134
Tangibility	0.227	0.142	0.233
R&D Expenses	0.035	0.000	0.081
Leverage	0.199	0.172	0.181
Return	0.193	0.111	0.708
Institutional Ownership	0.722	0.763	0.276
Board Size	9.255	9.000	2.686
Board Tenure	8.080	7.625	4.109
Board Independence	0.758	0.786	0.137
CEO-Chairman Duality	0.644	1.000	0.479
CEO Tenure	9.658	7.000	9.000

Table 2
Board of Directors and Firms' CSR Performance

This table shows regression estimates of firms' CSR performance on sustainability shocks and control variables. The dependent variables are a firm's CSR scores calculated using data from the MSCI KLD database. The sustainability shock measure is calculated based on sustainability reporting and regulatory requirements as shown in Appendix B. The sample period is 2001-2016. All variables are described in Appendix A. All variables are winsorized at the 1st and 99th percentiles. All models include firm and year fixed effects. All right-hand side variables are lagged by one year. Standard errors are clustered at the firm-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	MSCI KLD Scores $_t$		
	Overall	Environmental	Social
	(1)	(2)	(3)
Sustainability Shock $_{t-1}$	0.446***	0.264***	0.182**
	(5.00)	(6.40)	(2.55)
Log Total Assets $_{t-1}$	-0.006	-0.132***	0.126***
	(-0.11)	(-5.19)	(2.80)
Cash $_{t-1}$	0.193	0.185**	0.008
	(1.04)	(2.42)	(0.05)
Market-to-book $_{t-1}$	-0.000	0.001	-0.001
	(-0.05)	(0.34)	(-0.30)
Profitability $_{t-1}$	0.326	0.007	0.319*
	(1.63)	(0.08)	(1.89)
Tangibility $_{t-1}$	1.499***	0.081	1.417***
	(3.60)	(0.44)	(4.41)
R&D Expenses $_{t-1}$	-0.619	-0.405***	-0.214
	(-1.51)	(-2.71)	(-0.60)
Leverage $_{t-1}$	0.365*	0.274***	0.091
	(1.95)	(3.49)	(0.58)
Return $_{t-1}$	-0.019	0.001	-0.020*
	(-1.41)	(0.17)	(-1.70)
Institutional Ownership $_{t-1}$	-0.093	-0.076	-0.017
	(-1.04)	(-1.46)	(-0.29)
Log Board Size $_{t-1}$	0.061	-0.043	0.104
	(0.45)	(-0.72)	(0.91)
Log Board Tenure $_{t-1}$	-0.028	-0.088**	0.060
	(-0.32)	(-2.49)	(0.86)
Board Independence $_{t-1}$	0.342	-0.111	0.453**
	(1.46)	(-1.05)	(2.44)
CEO-Chairman Duality $_{t-1}$	0.078	0.034	0.044
	(1.27)	(1.28)	(0.85)
Log CEO Tenure $_{t-1}$	-0.037	0.020*	-0.057**
	(-1.39)	(1.85)	(-2.51)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	24,424	24,424	24,424
Adjusted R^2	0.594	0.472	0.568

Table 3
Board of Directors and Firms' CSR Performance: Social Subcategory Scores

This table shows regression estimates of firms' CSR performance on sustainability shocks and control variables. The dependent variables are a firm's social subcategory scores calculated using data from the MSCI KLD database. The sustainability shock measure is calculated based on sustainability reporting and regulatory requirements as shown in Appendix B. The sample period is 2001-2016. All variables are described in Appendix A. All variables are winsorized at the 1st and 99th percentiles. All models include firm and year fixed effects. All right-hand side variables are lagged by one year. Standard errors are clustered at the firm-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	MSCI KLD Scores $_{t}$				
	Employee	Product	Human Rights	Community	Diversity
	(1)	(2)	(3)	(4)	(5)
Sustainability Shock $_{t-1}$	0.090**	0.047**	0.021	0.023	0.002
	(2.14)	(1.97)	(1.56)	(1.12)	(0.06)
Log Total Assets $_{t-1}$	-0.002	-0.036*	0.013	-0.001	0.152***
	(-0.07)	(-1.96)	(1.26)	(-0.04)	(5.91)
Cash $_{t-1}$	0.028	-0.025	0.095***	0.024	-0.114
	(0.31)	(-0.48)	(3.56)	(0.62)	(-1.19)
Market-to-book $_{t-1}$	-0.000	-0.001	-0.000	0.000	-0.000
	(-0.01)	(-0.73)	(-1.29)	(0.33)	(-0.05)
Profitability $_{t-1}$	0.403***	0.035	-0.131***	-0.027	0.039
	(4.14)	(0.70)	(-3.50)	(-0.61)	(0.38)
Tangibility $_{t-1}$	0.319	0.092	0.375***	0.220***	0.411**
	(1.48)	(0.96)	(4.09)	(2.69)	(2.45)
R&D Expenses $_{t-1}$	-0.192	-0.189*	-0.089**	0.054	0.202
	(-0.91)	(-1.82)	(-2.15)	(0.72)	(0.94)
Leverage $_{t-1}$	0.016	0.015	0.008	0.081*	-0.029
	(0.15)	(0.29)	(0.30)	(1.90)	(-0.32)
Return $_{t-1}$	0.008	0.003	-0.004**	-0.008***	-0.019***
	(1.13)	(0.94)	(-2.23)	(-3.30)	(-2.71)
Institutional Ownership $_{t-1}$	-0.139***	-0.007	-0.018	0.028	0.118***
	(-2.99)	(-0.44)	(-1.36)	(1.57)	(3.09)
Log Board Size $_{t-1}$	0.080	-0.047	-0.021	0.031	0.060
	(1.16)	(-1.27)	(-0.75)	(0.94)	(0.91)
Log Board Tenure $_{t-1}$	0.083**	-0.001	-0.039**	0.026	-0.009
	(2.05)	(-0.05)	(-2.29)	(1.28)	(-0.24)
Board Independence $_{t-1}$	-0.032	-0.061	0.052	0.106*	0.388***
	(-0.28)	(-1.03)	(1.47)	(1.85)	(3.67)
CEO-Chairman Duality $_{t-1}$	0.017	0.026	-0.008	-0.001	0.010
	(0.54)	(1.59)	(-0.79)	(-0.08)	(0.33)
Log CEO Tenure $_{t-1}$	-0.016	-0.006	-0.007*	-0.010*	-0.017
	(-1.17)	(-0.86)	(-1.73)	(-1.65)	(-1.28)
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	24,424	24,424	24,424	24,424	24,424
Adjusted R^2	0.445	0.490	0.260	0.424	0.618

Table 4
Director Tenure and Firms' CSR Performance

This table shows regression estimates of firms' CSR performance on sustainability shocks and control variables. The shock variable is calculated based on directors with a minimum board tenure of three years. The dependent variables are a firm's CSR scores calculated using data from the MSCI KLD database. The sustainability shock measure is calculated based on sustainability reporting and regulatory requirements as shown in Appendix B. The sample period is 2001-2016. All variables are described in Appendix A. All variables are winsorized at the 1st and 99th percentiles. All models include firm and year fixed effects. All right-hand side variables are lagged by one year. Standard errors are clustered at the firm-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	MSCI KLD Scores $_{t}$		
	Overall	Environmental	Social
	(1)	(2)	(3)
Sustainability Shock (Min. 3 Years Tenure) $_{t-1}$	0.462***	0.312***	0.150*
	(4.75)	(6.68)	(1.89)
Log Total Assets $_{t-1}$	0.004	-0.125***	0.130***
	(0.08)	(-4.91)	(2.88)
Cash $_{t-1}$	0.189	0.182**	0.007
	(1.02)	(2.38)	(0.04)
Market-to-book $_{t-1}$	-0.000	0.001	-0.001
	(-0.04)	(0.36)	(-0.30)
Profitability $_{t-1}$	0.338*	0.014	0.323*
	(1.69)	(0.18)	(1.91)
Tangibility $_{t-1}$	1.509***	0.091	1.418***
	(3.63)	(0.49)	(4.42)
R&D Expenses $_{t-1}$	-0.568	-0.373**	-0.195
	(-1.40)	(-2.50)	(-0.55)
Leverage $_{t-1}$	0.371**	0.275***	0.095
	(1.99)	(3.52)	(0.61)
Return $_{t-1}$	-0.019	0.001	-0.020*
	(-1.39)	(0.14)	(-1.66)
Institutional Ownership $_{t-1}$	-0.089	-0.072	-0.017
	(-1.01)	(-1.42)	(-0.29)
Log Board Size $_{t-1}$	0.072	-0.037	0.109
	(0.53)	(-0.63)	(0.95)
Log Board Tenure $_{t-1}$	-0.038	-0.095***	0.057
	(-0.45)	(-2.69)	(0.82)
Board Independence $_{t-1}$	0.358	-0.101	0.459**
	(1.53)	(-0.96)	(2.47)
CEO-Chairman Duality $_{t-1}$	0.072	0.031	0.041
	(1.17)	(1.15)	(0.80)
Log CEO Tenure $_{t-1}$	-0.038	0.020*	-0.057**
	(-1.41)	(1.81)	(-2.51)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	24,424	24,424	24,424
Adjusted R^2	0.594	0.474	0.567

Table 5
Foreign Connections and Firms' CSR Performance

This table shows regression estimates of firms' CSR performance on foreign connections and control variables. The dependent variables are a firm's CSR scores calculated using data from the MSCI KLD database. Foreign connections is an indicator variable equal to one if the firm has at least one director with a board seat in a foreign firm, and zero otherwise. The sample period is 2001-2016. All other variables are described in Appendix A. All variables are winsorized at the 1st and 99th percentiles. All models include firm and year fixed effects. All right-hand side variables are lagged by one year. Standard errors are clustered at the firm-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	MSCI KLD Scores $_t$		
	Overall	Environmental	Social
	(1)	(2)	(3)
Foreign Connections $_{t-1}$	0.079	0.005	0.073
	(1.41)	(0.24)	(1.64)
Log Total Assets $_{t-1}$	-0.010	-0.133***	0.123***
	(-0.18)	(-5.19)	(2.73)
Cash $_{t-1}$	0.193	0.186**	0.008
	(1.04)	(2.42)	(0.05)
Market-to-book $_{t-1}$	-0.000	0.000	-0.001
	(-0.06)	(0.31)	(-0.30)
Profitability $_{t-1}$	0.335*	0.009	0.326*
	(1.67)	(0.11)	(1.93)
Tangibility $_{t-1}$	1.473***	0.064	1.409***
	(3.51)	(0.34)	(4.38)
R&D Expenses $_{t-1}$	-0.594	-0.390***	-0.204
	(-1.45)	(-2.62)	(-0.58)
Leverage $_{t-1}$	0.394**	0.295***	0.099
	(2.10)	(3.71)	(0.63)
Return $_{t-1}$	-0.018	0.002	-0.020*
	(-1.27)	(0.42)	(-1.66)
Institutional Ownership $_{t-1}$	-0.108	-0.085	-0.023
	(-1.15)	(-1.56)	(-0.38)
Log Board Size $_{t-1}$	0.058	-0.035	0.094
	(0.43)	(-0.59)	(0.82)
Log Board Tenure $_{t-1}$	-0.019	-0.085**	0.066
	(-0.22)	(-2.39)	(0.94)
Board Independence $_{t-1}$	0.358	-0.099	0.457**
	(1.52)	(-0.94)	(2.46)
CEO-Chairman Duality $_{t-1}$	0.073	0.030	0.043
	(1.17)	(1.10)	(0.83)
Log CEO Tenure $_{t-1}$	-0.037	0.020*	-0.058**
	(-1.40)	(1.88)	(-2.53)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	24,424	24,424	24,424
Adjusted R^2	0.592	0.467	0.567

Table 6
Do Sustainability Shocks Drive Firm's Corporate Governance?

This table shows regression estimates of measures of firms' corporate governance on sustainability shocks and control variables. The sustainability shock measure is calculated based on sustainability reporting and regulatory requirements as shown in Appendix B. The sample period is 2001-2016. All variables are described in Appendix A. All variables are winsorized at the 1st and 99th percentiles. All models include firm and year fixed effects. All right-hand side variables are lagged by one year. Standard errors are clustered at the firm-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Log Board Size $_t$	Log Board Tenure $_t$	Board Independence $_t$	CEO-Chairman Duality $_t$	Log CEO Tenure $_t$
	(2)	(3)	(4)	(5)	(6)
Sustainability Shock $_{t-1}$	-0.002	0.006	0.004	-0.013	0.015
	(-0.39)	(0.44)	(1.10)	(-0.83)	(0.48)
Log Total Assets $_{t-1}$	0.054***	0.082***	-0.001	0.044***	0.122***
	(11.63)	(7.15)	(-0.18)	(3.63)	(5.09)
Cash $_{t-1}$	-0.027*	-0.041	0.004	0.035	0.032
	(-1.68)	(-1.17)	(0.48)	(0.81)	(0.37)
Market-to-book $_{t-1}$	-0.000	0.000	-0.000	0.001	-0.000
	(-1.27)	(0.30)	(-0.21)	(1.38)	(-0.42)
Profitability $_{t-1}$	0.032**	0.099**	0.007	0.133***	0.233***
	(1.99)	(2.56)	(0.76)	(3.23)	(2.58)
Tangibility $_{t-1}$	-0.038	0.251***	0.002	0.042	0.325**
	(-1.32)	(3.66)	(0.09)	(0.55)	(2.22)
R&D Expenses $_{t-1}$	0.119***	0.226***	0.029	0.057	0.309*
	(3.37)	(2.90)	(1.57)	(0.62)	(1.71)
Leverage $_{t-1}$	0.016	0.034	0.011	-0.063	0.048
	(1.04)	(0.94)	(1.19)	(-1.60)	(0.60)
Return $_{t-1}$	0.001	-0.002	-0.000	0.005*	0.025***
	(0.68)	(-1.01)	(-0.08)	(1.88)	(3.92)
Institutional Ownership $_{t-1}$	-0.027**	0.026*	0.015*	-0.012	0.068**
	(-2.49)	(1.86)	(1.94)	(-0.73)	(2.01)
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	24,424	24,424	24,424	24,424	24,424
Adjusted R^2	0.831	0.769	0.745	0.653	0.488

Table 7
Firm Risk, Precautionary Motives, and Firms' CSR Performance

This table shows regression estimates of firms' CSR performance on sustainability shocks, interactions of shocks with measures of firm risk and precautionary motives, and control variables. The dependent variables are a firm's CSR scores calculated using data from the MSCI KLD database. The sustainability shock measure is calculated based on sustainability reporting and regulatory requirements as shown in Appendix B. Probability of Default is calculated using the naïve Merton model proposed in Bharath and Shumway (2008). R&D Expenses is research and development expenses divided by total book assets. R&D Expenses is set to zero when missing. Cash Flow Volatility is the standard deviation over the last ten years of a firm's operating cash flow (calculated as operating income before depreciation – interest expenses – taxes). The sample period is 2001-2016. All other variables are described in Appendix A. All variables are winsorized at the 1st and 99th percentiles. Control variables as in Table 2 are included but not reported. All models include firm and year fixed effects. All right-hand side variables are lagged by one year. Standard errors are clustered at the firm-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Distance to Default

	MSCI KLD Scores $_t$		
	Overall	Environmental	Social
	(1)	(2)	(3)
Sustainability Shock $_{t-1}$	0.452***	0.270***	0.182**
	(5.01)	(6.49)	(2.52)
Shock $_{t-1}$ × Prob. of Default $_{t-1}$	-0.250	-0.249***	-0.001
	(-1.38)	(-2.83)	(-0.01)
Prob. of Default $_{t-1}$	-0.165**	-0.066**	-0.098
	(-2.03)	(-2.39)	(-1.41)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	24,424	24,424	24,424
Adjusted R^2	0.594	0.473	0.568

Panel B: R&D Expenses

	MSCI KLD Scores $_t$		
	Overall	Environmental	Social
	(1)	(2)	(3)
Sustainability Shock $_{t-1}$	0.504***	0.291***	0.212***
	(5.32)	(6.67)	(2.77)
Shock $_{t-1}$ × R&D Expenses $_{t-1}$	-1.468***	-0.700***	-0.767
	(-2.68)	(-3.27)	(-1.64)
R&D Expenses $_{t-1}$	-0.233	-0.221	-0.012
	(-0.54)	(-1.40)	(-0.03)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	24,424	24,424	24,424
Adjusted R^2	0.594	0.473	0.568

Panel C: Cash Flow Volatility

	MSCI KLD Scores $_{t}$		
	Overall	Environmental	Social
	(1)	(2)	(3)
Sustainability Shock $_{t-1}$	0.553***	0.373***	0.180**
	(5.15)	(7.30)	(2.09)
Shock $_{t-1}$ × Cash Flow Volatility $_{t-1}$	-2.453***	-2.157***	-0.296
	(-3.41)	(-6.24)	(-0.50)
Cash Flow Volatility $_{t-1}$	-0.576	0.012	-0.588
	(-1.11)	(0.06)	(-1.40)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	23,600	23,600	23,600
Adjusted R^2	0.596	0.478	0.568

Table 8
Dirty vs. Clean Industries and Firms' CSR Performance

This table shows regression estimates of firms' CSR performance on sustainability shocks, interactions of shocks with an indicator variable equal to one for firms from 'dirty' industries, and zero otherwise, and control variables. The dependent variables are a firm's CSR scores calculated using data from the MSCI KLD database. The sustainability shock measure is calculated based on sustainability reporting and regulatory requirements as shown in Appendix B. We follow Dyck et al. (2020) to classify industries as 'dirty' and 'clean' based on the SASB materiality map. Using the 11 sub-categories from the SASB sections about environmental performance (Environment and Business Model and Innovation) a score is calculated as 2 points if classified as "material for more than 50% of industries in the sector", 1 point if "material for less than 50% of industries", and 0 points if "issue not likely to be material for any industries". These scores suggest that the sectors that are most material ('dirty') are SIC Divisions A (Agriculture, Forestry, And Fishing), B (Mining), and I (Services). SIC Divisions C (Construction), D (Manufacturing), E (Transportation), F (Wholesale Trade), G (Retail Trade), and H (Finance) are considered as 'clean' industries. The sample period is 2001-2016. All variables are described in Appendix A. All variables are winsorized at the 1st and 99th percentiles. Control variables as in Table 2 are included but not reported. All models include firm and year fixed effects. All right-hand side variables are lagged by one year. Standard errors are clustered at the firm-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	MSCI KLD Scores $_{t}$		
	Overall	Environmental	Social
	(1)	(2)	(3)
Sustainability Shock $_{t-1}$	0.468***	0.334***	0.134*
	(4.66)	(7.06)	(1.66)
Shock $_{t-1}$ × Dirty Industry $_{t-1}$	-0.152	-0.365***	0.213
	(-0.76)	(-3.88)	(1.33)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	24,424	24,424	24,424
Adjusted R^2	0.595	0.473	0.569

Table 9
Sustainability Shocks and Firms' Operating Performance and Productivity

This table shows regression estimates of firms' performance and productivity on sustainability shocks and control variables. The sustainability shock measure is calculated based on sustainability reporting and regulatory requirements as shown in Appendix B. We measure firms' performance and productively with profitability (operating income before depreciation divided by total book assets), log sales (natural logarithm of sales), labor productivity (natural logarithm of sales divided by the number of full-time-equivalent employees), and capital productivity (natural log of sales divided by net PP&E). The sample period is 2001-2016. All other variables are described in Appendix A. All variables are winsorized at the 1st and 99th percentiles. Control variables as in Table 2 are included but not reported. All models include firm and year fixed effects. All right-hand side variables are lagged by one year. Standard errors are clustered at the firm-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Performance		Productivity	
	Profitability $_{t}$	Log Sales $_{t}$	Labor Productivity $_{t}$	Capital Productivity $_{t}$
	(1)	(2)	(3)	(4)
Sustainability Shock $_{t-1}$	0.006**	0.045***	0.065***	0.056***
	(2.49)	(3.33)	(4.80)	(3.32)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	37,942	38,022	36,500	37,242
Adjusted R^2	0.784	0.982	0.903	0.965

Appendix A
Variable Definitions

This table describes the variable construction and the data sources for each variable.

Variables	Description
A. Sustainability Shock Measures	
For each company, we create a map of director connections to foreign (non-U.S.) countries. A firm has a foreign connection when a director serves on a board of a firm in a foreign country. We then link a firm's foreign director connections to sustainability shocks that occurred in foreign countries. Sustainability shocks are newly introduced mandatory laws, policies, regulations, or disclosure requirements pertaining to a firms' sustainability as tabulated in Appendix B. *Sources*: We obtain a list of such new rules around the world from Carrots & Sticks (KPMG, GRI, UNEP, and CCGA). The data on director connections are from BoardEx.	
Sustainability Shock	An indicator variable that is equal to one if a firm experienced a sustainability shock through its directors with foreign connections, and zero otherwise. Once the variable turns on for a given firm, it stays at 'one' for the rest of the sample period.
Sustainability Shock (Min. 3 Years Tenure)	An indicator variable that is equal to one if a firm experienced a sustainability shock through its directors with foreign connections and a minimum of three years of board tenure, and zero otherwise. Once the variable turns on for a given firm, it stays at 'one' for the rest of the sample period.
Sustainability Shock Intensity (Country)	A count variable equal to the sum of sustainability shocks a firm experienced through its directors with foreign connections. If a firm experiences a shock multiple times through more than one director connection to the same foreign country, we count such a shock only once.
Sustainability Shock Intensity (Director)	A count variable equal to the sum of sustainability shocks a firm experienced through its directors with foreign connections. We count all shocks also those a firm experiences multiple times through more than one director connection to the same foreign country.
B. CSR Scores	
MSCI KLD Scores	
Overall	Measures the overall CSR performance of a firm. The score is calculated as the sum of positive minus the sum of negative sustainability performance indicator variables in the categories Environmental, Community, Diversity, Employee, Human Rights, and Product. This difference is then normalized to be zero at its minimum value. *Source*: MSCI KLD.
Environmental	Measures the environmental sustainability performance of a firm. The score is calculated as the sum of positive minus the sum of negative sustainability performance indicator variables in the Environmental category. This difference is then normalized to be zero at its minimum value. *Source*: MSCI KLD.
Social	Measures the social sustainability performance of a firm. The score is calculated as the sum of positive minus the sum of negative sustainability performance indicator variables in the categories Community, Diversity, Employee, Human Rights, and Product. This difference is then normalized to be zero at its minimum value. *Source*: MSCI KLD.
Social Subcategories: Employee, Product, Human Rights, Community, Diversity	Measures the social sustainability subcategory performance of a firm. The score is calculated as the sum of positive minus the sum of negative sustainability performance indicator variables in a social subcategory. This difference is then normalized to be zero at its minimum value. *Source*: MSCI KLD.

Thomson Reuters Scores	
Overall	Measures the overall CSR performance of a firm. The score is the average of the environmental and social sustainability scores. *Source*: Thomson Reuters ESG.
Environmental	Measures the environmental performance of a firm. The score is calculated by and obtained from Thomson Reuters. It is calculated as a percentile score and measures a firm's environmental performance relative to its industry peers each year. The score is based on items in the categories Resource Use, Emissions, and Innovation. *Source*: Thomson Reuters ESG.
Social	Measures the social performance of a firm. The score is calculated by and obtained from Thomson Reuters. It is calculated as a percentile score and measures a firm's social performance relative to its industry peers in a given year. The score is based on items in the categories Workforce, Human Rights, Community, and Product Responsibility. *Source*: Thomson Reuters ESG.
C. Control Variables	
Total Assets	Total book assets in $ million. *Source*: Compustat.
Cash	Cash and cash equivalents divided by total book assets. *Source*: Compustat.
Market-to-book	Stock price multiplied by the number of shares outstanding divided by total book shareholders' equity. *Source*: Compustat.
Profitability	Operating income before depreciation divided by total book assets. *Source*: Compustat.
Tangibility	Net property, plant, and equipment divided by total book assets. *Source*: Compustat.
R&D Expenses	Research and development expenses divided by total book assets. R&D Expenses is set to zero when missing. *Source*: Compustat.
Leverage	Total short- and long-term debt divided by total book assets. *Source*: Compustat.
Return	One-year raw stock return over the firm's fiscal year. *Source*: CRSP.
Institutional Ownership	Percentage of company shares held by institutional owners reported on Form 13-F. *Source*: Thomson Reuters s34.
Board Size	Number of directors on a firm's board. *Source*: BoardEx.
Board Tenure	Average age of the directors on a firm's board. *Source*: BoardEx.
Board Independence	Fraction of independent directors calculated as the number of independent directors divided by the total number of directors on a firm's board. *Source*: BoardEx.
CEO-Chairman Duality	Dummy variable equal to one if the CEO is the Chairman of the board, and zero otherwise. *Source*: BoardEx.
CEO Tenure	CEO's tenure in years. *Source*: BoardEx.

Appendix B
Mandatory Sustainability Regulations and Reporting Standards Across the World

This table shows sustainability reporting and regulation requirements introduced across the world for the period 2000-2016. The data are obtained from Carrots & Sticks, a joint effort to compile international sustainability reporting regulation and policy KPMG, GRI, UNEP, and the University of Stellenbosch. We use all mandatory rules that apply to all companies. We drop rules that apply only to a subset of firms (by industry or geography) or state-owned firms.

Country	Year Passed	Rule Title	Description
Argentina	2004	National Labor Law No. 25877, Social Balance	Publish annual report on social impact.
	2008	Law No. 2594, Social and Environmental Responsibility Balance	Generate sustainability report.
Australia	2001	Corporations Act, Sec 299	Disclose whether operations are subject to any significant environmental regulations.
	2003	Australian Securities and Investments Commission, Sec 1013DA, Disclosure Guidelines	Disclose about labor standards or environmental, social and ethical considerations in Product Disclosure Statements (PDS).
	2003	Australian Stock Exchange, Listing Rule 4.10.3	Establish a code of conduct on issues related to the community, pollution and environmental controls, and how sustainability considerations have been integrated into the company's risk management process.
	2008	National Greenhouse and Energy Reporting Regulations	Disclose on greenhouse gas emissions and energy consumption and production.
	2011	Carbon Credits (Carbon Farming Initiative) Act	Act to reduce GHG emissions.
	2012	Workplace Gender Equality Act	Act to improve and promote equality for both women and men in the workplace.
Belgium	2003	Social Balance Sheet	Publish a social balance sheet.
	2008	Social Balance Sheet, Amendments	Publish a social balance sheet (amended rule).
Canada	2004	TSX Timely Disclosure Policy	Requires immediate disclosure of material E&S issues.
	2015	National Instrument 58-101 Disclosure of Corporate Governance Practices/Gender Equality	Increase transparency regarding the representation of women on boards of directors and in senior management.
Chile	2015	Norma de Carácter General, No 386	Report on workplace gender diversity incl. gender wage difference.
	2015	Norma de Carácter General, No 385	Disclose ESG practices.
China	2008	Shanghai Stock Exchange, Guidelines on Environmental Information Disclosure	Disclose CSR (environmental and social) practices.
	2008	Green Securities Policy	Disclose enhanced information on environmental record.
	2008	Environmental Information Disclosure Act	Disclose environmental information according to regulatory requirements.
Denmark	2001	Danish Financial Statements Act	Report on material environmental aspects.
	2008	Financial Statements Act	Report on CSR in separate section in annual report.
	2013	Financial Statements Act, Amendments	Report on climate change, human rights, and gender diversity in annual report.
	2015	Financial Statements Act, Amendments	Report on expanded list of issues in CSR section in annual report.
Finland	2006	General guidelines for recording, accounting and disclosing of environmental issues	Disclose environmental issues as part of financial statements.
	2014	Non-Discrimination Act	Act to promote equality and prevent discrimination.
France	2001	Law No 2001-397	Report on gender equality in the workplace.
	2001	New Economic Regulations Act, Art 116	Disclose social and environmental impacts in annual report.
	2010	Code de l'Enivronnement, Livre II, Titre II, Art L229-25	Disclose scope 1 and 2 greenhouse gas emissions.
	2012	Grenelle Act II, Art 225	Disclose third-party-verified environmental and social performance in annual report.

	2013	Law no 2013-619, Art 8	Requires energy audit with significant penalties.
	2015	French Energy Transition Law, Art 173	Disclose financial risks due to climate change and strategies to manage those risks.
	2016	French Energy Transition Law, Art 70, 173	Extends the list of information required by Grenelle Act II.
Germany	2005	Bilanzrechtsreformgesetz	Report on environmental and social matters and related key performance indicators.
	2012	Bilanzrechtsreformgesetz, Amendments	Publish a group management report with non-financial key indicators, including sustainability indicators in the annual report.
Greece	2006	Law 3487	Report financial and non-financial indicators related to business activity, including employee relations and environmental issues.
Hong Kong	2014	New Companies Ordinance	Report on environmental and social policies and performance.
	2015	HKEx Listing Rules, Disclosure of Financial Information	Extend New Companies Ordinance to all listed companies.
	2016	HKEx Environmental, Social/Governance Reporting Guide	Publish annual ESG report.
Hungary	2004	Accounting Act, Act C, Sec 95	Requires limited non-financial reporting in annual report.
Iceland	2001	National Regulation on Green Accounting	Disclose environmental sustainability information in annual report.
	2002	National Regulation on Green Accounting, Amendments	Amendments to National Regulation on Green Accounting
India	2003	Corporate Responsibility for Environmental Protection	Act to prevent and control of pollution.
	2003	Securities and Exchange Board of India, Committee on Corporate Governance	Submit a quarterly compliance report considering a broader set of stakeholders and taking into account societal concerns about labor and the environment.
	2015	Securities and Exchange Board of India, Business Responsibility Reports	Submit a business responsibility report on environmental, social, and economic responsibilities.
Indonesia	2012	Capital Markets Supervisory Agency, KEP-431/BL/2012	Disclose on corporate social responsibility in annual report or CSR report.
Israel	2009	Securities Law Regulations, Amendments	Report on material environmental risks and the management of those risks.
	2010	Securities Law Regulations, Amendments	Report on material environmental risks and the management of those risks.
	2012	Environmental Protection Law	Requires reporting pollution with central Pollutant Release and Transfer Register.
Italy	2007	Legislative Decree No 32/2007	Report on employee relations and environmental performance in the annual report.
Japan	2005	Mandatory GHG Accounting System	Disclose GHG emissions.
	2005	Law Concerning the Promotion of Business Activities with Environmental Consideration	Publish an annual environmental report.
Kazakhstan	2009	Stock Exchange Listing Requirements	Report on ESG policies and practices in the annual report.
Kenya	2015	Capital Markets Act	Report and promote ESG policies that go beyond the minimum prescribed by law.
South Korea	2012	Environmental Information Disclosure Policy	Disclose environmental information.
	2012	Green Posting System	Disclose GHG emissions and energy usage in the annual report.
	2013	Disclosure on Executive Gender	Disclose the gender of the executives in the annual report.
Kuwait	2015	Executive Regulations, Book 15	Report on corporate social responsibility policies.
Malaysia	2007	Listing Requirements, CSR Framework	Report CSR activities or practices.
	2012	Environmental Quality Act	Requires environmental impact assessment or environmental audit.
	2015	Listing Requirements, Sustainability Statement in Annual Reporting	Report a sustainability statement covering material sustainability matters in the annual report.
Mexico	2012	National Emissions Register	Law sets requirements for mandatory emissions measurement, reporting and verification, and created a public emissions registry.
Netherlands	2006	Dutch Civil Code, Amendments	Disclose information about the environment, employees, and risks in the annual report.
Nigeria	2008	Code of Corporate Governance for Public Companies	Requires sustainability disclosures.
Norway	2013	Norwegian Accounting Act, Amendments	Report on policies related to human rights, labor rights, environmental and social issues.

	2014	Norwegian Code of Practice for Corporate Governance	Report on corporate values and formulate ethical and corporate social responsibility guidelines.
Peru	2015	Resolution SMV No 033-2015-SMV/01	Requires mandatory sustainability reporting.
Philippines	2009	Corporate Social Responsibility Act	CSR act mandates corporations to consider the interests of society by taking responsibility for the impact of their activities on customers, employees, shareholders, communities, and the environment in all aspects of their operations.
Portugal	2006	Law 19/2006 on Access to Environmental Information	Disclose environmental information in annual report.
	2009	Social Balance Law	Issue a social balance report.
	2010	Financial Reporting Accounting Standard, No 26	Disclose environmental information in annual report.
Romania	2005	Government Decision, No 878/2005	Disclose environmental information, including environmental impact assessment reports and environmental authorizations.
	2006	Government Decision, No 780/2006	Report on GHG emissions. Establish a scheme for GHG emission allowance trading.
	2013	Government Decision, No 780/2006, Amendments	Amendments No 780/2006.
Russia	2013	Government Directive 1710-13	Disclose information on sustainable development and environmental responsibility.
	2014	Regulation No 454-P	Disclose use of energy resources, code of corporate governance, and economic impacts.
Singapore	2012	Revised Code of Corporate Governance	Broadens the responsibility of the board of directors to include sustainability and ethical guidance and to consider environmental and social risks to the company.
South Africa	2010	Johannesburg Stock Exchange, Listing Requirement	Requires annual reporting on social, environmental and economic performance.
	2012	Employment Equity Act, Amendments	Report on workplace discrimination. Submit annual employment equity report.
Spain	2002	ICAC Resolution	Requires including environmental assets, provisions, investments and expenses in their annual financial statements
	2007	National Accounting Plan	Report on environmental and social practices.
Sweden	2005	Annual Accounts Act, Amendments	Requires disclosure of environmental and social information in annual report.
Taiwan	2015	Taiwan Stock Exchange, Corporate Social Responsibility Reports	Requires annual GRI G4-based corporate social responsibility reporting.
Thailand	2014	Rules, Conditions and Procedures for Disclosure Regarding Financial and Non-financial Information of Securities Issuers	Requires CSR disclosures in annual report.
Turkey	2003	Labour Law No 4857	Report on occupational health and safety-related performance indicators; address discrimination against individuals with special needs.
	2006	Environment Law No 2872, Amended by Law No 5491	Report on environmental impacts.
	2007	Energy Efficiency Law	Report on energy management activities.
	2011	Communiqué on Corporate Governance Principles	Disclose principles related to human resources policy, responsibilities towards customers, suppliers, and code of ethics and social responsibility.
	2012	Occupational Health and Safety Law No 6331	Extends the scope of Labour Law No 4857
	2012	Regulation on Monitoring of Greenhouse Gas Emissions	Report on GHG emissions.
	2014	Consumer Protection Act No 6502	Report on environmental and social hazards of products and services.
U.K.	2008	Climate Change Act, GHG Reporting	Report on GHG emissions.
	2010	Carbon Reduction Commitment (CRC) Energy Efficiency Scheme	Mandatory carbon emissions reduction scheme. Requires measuring and report on all emissions related to energy use to the Environment Agency.
	2013	Companies Act, Amendments	Publish a strategic report enhancing reporting on GHG emissions, human rights, and diversity.
	2013	Modern Slavery Act	Requires policies against modern slavery and human trafficking.

Appendix C
Additional Tests

Table C1
Board of Directors and Firms' CSR Performance: Non-executive Directors

This table shows regression estimates of firms' CSR performance on sustainability shocks and control variables. The dependent variables are a firm's CSR scores calculated using data from the MSCI KLD database. The sustainability shock measure is calculated based on sustainability reporting and regulatory requirements as shown in Appendix B. The shock variable is calculated using non-executive directors only. The sample period is 2001-2016. All variables are described in Appendix A. All variables are winsorized at the 1st and 99th percentiles. Control variables as in Table 2 are included but not reported. All models include firm and year fixed effects. All right-hand side variables are lagged by one year. Standard errors are clustered at the firm-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	MSCI KLD Scores $_t$		
	Overall	Environmental	Social
	(1)	(2)	(3)
Sustainability Shock $_{t-1}$	0.444***	0.266***	0.177**
	(4.93)	(6.37)	(2.43)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	24,424	24,424	24,424
Adjusted R^2	0.594	0.472	0.568

Table C2
Shock Intensity and Firms' CSR Performance

This table shows regression estimates of firms' CSR performance on sustainability shock intensity and control variables. The dependent variables are a firm's CSR scores calculated using data from the MSCI KLD database. The sustainability shock measures are calculated based on sustainability reporting and regulatory requirements as shown in Appendix B. In Panel A, the sustainability shock intensity is measured at the country level with every additional shock in a connected foreign country increasing the shock variable by one. In Panel B, the sustainability shock intensity is measured at the director level with every additional director exposed to a shock increasing the shock variable by one. The sample period is 2001-2016. All variables are described in Appendix A. All variables are winsorized at the 1st and 99th percentiles. Control variables as in Table 2 are included but not reported. All models include firm and year fixed effects. All right-hand side variables are lagged by one year. Standard errors are clustered at the firm-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Sustainability Shock Intensity at the Country Level

	MSCI KLD Scores $_{t}$		
	Overall	Environmental	Social
	(1)	(2)	(3)
Sustainability Shock Intensity (Country) $_{t-1}$	0.270***	0.213***	0.057
	(5.96)	(9.54)	(1.41)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	24,424	24,424	24,424
Adjusted R^2	0.596	0.486	0.567

Panel B: Sustainability Shock Intensity at the Director Level

	MSCI KLD Scores $_{t}$		
	Overall	Environmental	Social
	(1)	(2)	(3)
Sustainability Shock Intensity (Director) $_{t-1}$	0.217***	0.157***	0.059*
	(5.81)	(7.84)	(1.88)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	24,424	24,424	24,424
Adjusted R^2	0.596	0.484	0.568

Table C3
Board of Directors and Firms' CSR Performance: Three Years Surrounding the Sustainability Shocks

This table shows regression estimates of firms' CSR performance on sustainability shocks and control variables for the three years surrounding the sustainability shocks. The dependent variables are a firm's CSR scores calculated using data from the MSCI KLD database. The sustainability shock measure is calculated based on sustainability reporting and regulatory requirements as shown in Appendix B. The sample period is 2001-2016. All variables are described in Appendix A. All variables are winsorized at the 1st and 99th percentiles. Control variables as in Table 2 are included but not reported. All models include firm and year fixed effects. All right-hand side variables are lagged by one year. Standard errors are clustered at the firm-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	MSCI KLD Scores $_t$		
	Overall	Environmental	Social
	(1)	(2)	(3)
Sustainability Shock $_{t-1}$	0.332***	0.209***	0.123*
	(4.24)	(5.90)	(1.88)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	21,090	21,090	21,090
Adjusted R^2	0.602	0.492	0.599

Table C4
Board of Directors and Firms' CSR Performance: Standardized MSCI KLD Scores

This table shows regression estimates of firms' CSR performance on sustainability shocks and control variables. The dependent variables are a firm's CSR scores calculated using data from the MSCI KLD database. We sum up all positive sustainability performance indicators, subtract all negative indicators, and divide by the total number of reported indicator variables. The sustainability shock measure is calculated based on sustainability reporting and regulatory requirements as shown in Appendix B. The sample period is 2001-2016. All variables are described in Appendix A. All variables are winsorized at the 1st and 99th percentiles. Control variables as in Table 2 are included but not reported. All models include firm and year fixed effects. All right-hand side variables are lagged by one year. Standard errors are clustered at the firm-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Standardized MSCI KLD Scores $_t$		
	Overall	Environmental	Social
	(1)	(2)	(3)
Sustainability Shock $_{t-1}$	0.012***	0.022***	0.009***
	(6.12)	(6.59)	(4.14)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	24,424	24,424	24,424
Adjusted R^2	0.557	0.452	0.531

Table C5
Board of Directors and Firms' CSR Performance: Thomson Reuters Scores

This table shows regression estimates of firms' CSR performance on sustainability shocks and control variables, using alternative CSR performance measures obtained from Thomson Reuters ESG. The sustainability shock measure is calculated based on sustainability reporting and regulatory requirements as shown in Appendix B. The sample period is 2001-2016. All variables are described in Appendix A. All variables are winsorized at the 1st and 99th percentiles. Control variables as in Table 2 are included but not reported. All models include firm and year fixed effects. All right-hand side variables are lagged by one year. Standard errors are clustered at the firm-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Thomson Reuters Scores $_{t}$		
	Overall	Environmental	Social
	(1)	(2)	(3)
Sustainability Shock $_{t-1}$	1.765***	1.776**	1.753**
	(2.77)	(2.12)	(2.57)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	12,571	12,571	12,571
Adjusted R^2	0.828	0.796	0.775