Renewable Governance: Good for the Environment?

Alexander Dyck
University of Toronto

Karl V. Lins
University of Utah

Lukas Roth
University of Alberta

Mitch Towner
University of Arizona

Hannes F. Wagner
Bocconi University

March 31, 2020

We test the impact of firms' corporate governance structures (G) on firms' environmental performance (E) in an international sample. We find strong evidence that better governance improves firms' environmental performance, including in settings where environmental risks are most salient. Governance mechanisms that focus on board renewal through enhanced investor power in director elections or appointment of female directors are associated with the greatest improvements. Quasi-exogenous shocks to these board renewal mechanisms support a causal interpretation—that is, G drives E. Female directors have a stand-alone impact, as the positive female director effect holds when we directly control for director characteristics.

Keywords: Environmental performance, Ownership structure, Sustainability, Corporate social responsibility, ESG, Corporate governance

JEL Classification: G15, G23, G32

Author contacts: adyck@rotman.utoronto.ca; karl.lins@eccles.utah.edu; lukas.roth@ualberta.ca; mitchtowner@email.arizona.edu; and hannes.wagner@unibocconi.it. We thank Bo Becker, Douglas Cumming, Shaun Davies, Dirk Jenter, Adair Morse, Laura Starks, seminar participants at the Hong Kong Baptist University, Temple University, University of Alberta, University of Arizona, University of Geneva, University of Illinois at Chicago, University of Nebraska, University of Bern, University of Neuchatel, and participants at the 2019 American Finance Association Meeting, 2019 International Workshop on Financial System Architecture and Stability, 2019 Telfer Conference on Accounting and Finance, 2019 Queens Conference on Green Finance: New Directions in Sustainable Finance Research and Policy, 2019 ECGI and Bar Ilan University Conference on Executive Compensation and on Sustainability, 2018 Swedish House of Finance Conference on Sustainable Finance, 2018 UN PRI Academic Network Conference, and 2018 University of Tennessee Smokey Mountain Finance Conference for helpful comments and suggestions. We are grateful to the Social Sciences and Humanities Research Council of Canada for financial support. Lukas Roth gratefully acknowledges financial support from the Winspear Endowed Roger S. Smith Senior Faculty Fellowship.

"Given the groundwork we have already laid engaging on disclosure, and the growing investment risks surrounding sustainability, we will be increasingly disposed to vote against management and board directors when companies are not making sufficient progress on sustainability-related disclosures and the business practices and plans underlying them."

—Larry Fink, CEO of Blackrock, January 14, 2020

1. Introduction

Institutional investors are increasingly concerned about environmental sustainability and a lack of action by some firms to address it. In the survey of Krueger, Sautner, and Starks (2019), institutional investors state that environmental risks have financial implications for their portfolio firms and that these risks have begun to materialize. These investors also state that engagement is important to address these risks, and more so than divestment. The core investor concern is captured in the theoretical framework of Bénabou and Tirole (2010)—insiders, when short-term oriented, will not invest enough today to mitigate future environmental risks.

The control rights outsiders obtain with ownership should provide influence over corporate actions such as improving environmental performance, and cause insiders to pay attention to their concerns. However, the extensive international corporate governance literature shows that it is naïve to expect higher ownership stakes to automatically provide outsiders with greater control. Control rights are meaningful only when there is effective governance. Thus, in this paper we hypothesize that outside investors need effective governance to be present if, through engagement, they seek to improve environmental sustainability in the firms they hold.

We address this hypothesis using a sample of 3,293 firms from 41 countries. We construct a range of comprehensive firm-level environmental performance measures using line items (covering areas such as CO2 emissions, renewable energy use, and waste recycling ratios) from a comprehensive global environmental data provider. First, we ask whether better governance mechanisms (G) facilitate improvements in firms' environmental performance (E)—that is, does G drive E? To the extent this is true, investors should prioritize engagements to improve governance and not just focus directly on environmental engagements. Second, we ask what

specific aspects of governance provide the greatest impact in terms of improved environmental performance? By addressing these questions, we provide a roadmap that investors can use to maximize the environmental performance returns from their engagement efforts.

We first explore the impact of G on E by measuring governance using 'traditional' methods that include whether a firm is family controlled or line items such as "Is a majority of the board independent?" or "Is the CEO the chair of the board?", among others. However, as the opening paragraph points out—there appears to be a growing gap between outside investors and insiders on the importance of taking concrete actions to address environmental risks. To change firm policies there may be a need to use not just traditional governance but also what might be called 'contemporary' governance mechanisms that plausibly renew the mindset of the board.

To achieve board renewal, Bebchuk and Hamdani (2017) point out that investors increasingly seek a strong voting process that gives them greater power to nominate and elect their preferred directors. Investors have generally moved beyond the traditional request for board independence, given the incentives nominally independent directors may have to side with insiders (e.g., Coles, Daniel, and Naveen, 2014). To this end, we first study board renewal via the adoption of majority voting rules, which require that a board member receives more than 50% of the votes cast (compared to a requirement to receive a plurality of votes cast), as this makes it easier for outside investors to prevent insiders' candidates from joining the board (e.g., Cunat, Gine, and Guadelupe, 2012; Ertimur, Ferri, and Oesch, 2013; Doidge, Dyck, Mahmudi, and Virani, 2019).

The second contemporary governance mechanism we study is forced board renewal, coming from investor and/or societal pressures. As Brav, Jiang, Partnoy, and Thomas (2008) and Becht, Franks, Grant, and Wagner (2017) note, replacing directors is frequently required to achieve policy changes when a wide gap in thinking exists between investors and insiders. A significant example of forced board renewal around the world is the concerted effort to increase female board representation. Thus, we employ female board representation as a proxy for board renewal. Ahern and Dittmar (2012) find that female board members are less likely than male board members to be

insiders (and thus more independent) and are younger, while Kim and Starks (2016a) find that skill sets of boards are enhanced by female directors, including governance skills.

These two contemporary governance mechanisms have a further advantage—in some countries in our sample outside pressures forced adoption of either majority voting rules or female board representation. These quasi-exogenous shocks to contemporary governance mechanisms help us to identify the impact of governance on firms' environmental performance.

Our results show that, relative to widely held firms, firms with a family blockholder have 8% to 11% lower environmental performance, depending on the specification. Thus, when insiders, who are likely to be short-term oriented, are also firmly entrenched, environmental performance suffers. When we measure governance based on traditional governance line items, we find that adding a good-governance line item increases a firm's environmental performance by 2% to 3%.

We find much stronger results for mechanisms that plausibly renew the thinking of the board. When outsiders have greater control rights arising from the adoption of majority voting provisions, environmental performance improves by 7% to 9%. Further, when measuring board renewal with the introduction of a female director, environmental performance increases by 11% to 15%. Thus, our results show that investors who wish to persuade firms to improve their environmental performance should focus primarily on improving contemporary governance mechanisms. We confirm that these results hold when we build a materiality-weighted environmental performance score that uses only line items for financially material issues for a company's particular industry as determined by the Sustainability Accounting Standards Board (SASB). We also confirm that the contemporary governance results obtain even when we control for director characteristics of each firm's board for each year, suggesting that board renewal does not only work through board turnover, but also through increased pressure on existing board members.

A natural concern is that an omitted factor affects both the strength of governance and a firm's environmental performance (e.g., Hermalin and Weisbach, 2003). We address this endogeneity concern with a number of additional tests. Given the international setting, challenges remain with each of these tests, but collectively they strongly suggest that improving governance leads to higher subsequent environmental performance. To begin, we confirm in firm fixed effects specifications that when a firm improves either its traditional or contemporary governance, it subsequently has stronger environmental performance. Next, we identify outside shocks to contemporary governance mechanisms in some countries—that is, mandated quotas that firms 'add a female director' and quasi-exogenous external pressure from investors that drive firms to 'adopt majority voting'. We estimate difference-in-differences specifications, comparing the subsequent environmental performance of firms affected by the 'treatment' to otherwise similar unaffected firms. In these sub-samples, firms that add one or more female directors increase their environmental performance by 6% to 15% and firms that adopt majority voting increase their environmental performance by 21% to 40%. Again, these tests support an interpretation that improving governance leads to higher subsequent environmental performance.

Next, we conduct additional tests to understand whether the relationship between G and E holds in settings where environmental risks are likely more salient. We first focus on countries with low environmental performance. In these countries the scope for improvement is the largest but at the same time investors will need to overcome local societal norms that tolerate weak average environmental performance. Our tests show that better governance generates environmental returns in this challenging setting, and this is particularly true for contemporary governance mechanisms aimed at renewing the mindset of the board.

We then investigate family firms as these have significantly weaker environmental performance. In our international sample families control 23% of the firms, and thus by definition have very strong control rights. We find that neither traditional governance line items nor majority voting procedures impact the environmental performance of family-controlled firms—a not-

surprising result, as family insiders likely have enough voting rights to effectively have full control of the firm and its board. However, board renewal as measured by having a female director does matter—family firms with a female director have significantly higher environmental performance.

Third, we test whether governance matters for specific components of environmental performance, separating components that address emission or resource reduction from those that assess product innovation. Fourth, we examine the impact of governance in subsets of industries identified as 'dirty.' In these tests, all governance mechanisms remain statistically significant with comparable coefficients.

Finally, we tackle the issue of whether the positive impact of female board members on environmental performance is attributable to specific characteristics that might be correlated with gender. Ahern and Dittmar (2012), for example, document in their sample that compared to existing male directors, new female directors have significantly less CEO experience, are younger, and are more highly educated. Further, they find that after controlling for these characteristics, there is no longer a robust relationship between female board membership and performance. We obtain similar director characteristics data for each director in our sample. We find similar differences in characteristics between female and male board members; however, when we control for these differences in our regressions, we continue to find a significant positive impact of director gender.

There is a persistent strong positive effect of having a female director on firms' environmental performance across all our regressions. This is a powerful and intriguing result. We conjecture, based on extant research, that this positive impact could arise from any of three broad reasons: female directors as new board members shake up the type of 'groupthink' as discussed in Janis (1972); they bring new unobserved corporate governance skills (Kim and Starks (2016a); and/or females have stronger innate preferences for other-regarding behavior such as making environmental investments that have positive social externalities (Adams and Funk, 2012;

Cronqvist and Yu, 2017). Unfortunately, existing data do not allow us to differentiate between these explanations in our international sample of firms.

Taken together, this evidence provides investors with a roadmap to use if they seek to improve the environmental performance of firms around the world. Investors that prioritize governance improvements will generate improvements in E, as we find that all forms of G improve E. Further, we find the greatest returns from engagements that focus on renewing the mindset of the board.

Our paper adds to a large literature on corporate social responsibility (CSR)/ESG.[1] Within this broad literature, surprisingly few studies have explored the impact of governance on environmental or social performance, and all of these focus on traditional governance metrics. Krueger (2015) finds that firms with agency problems (as proxied by leverage and liquidity) benefit less from positive CSR changes. Ferrell, Liang, and Renneboog (2016) explore whether agency problems affect firms' CSR scores, assuming governance directly affects compensation, and thus can indirectly impact E and S scores. El Ghoul, Guedhami, Kwok, and Wang (2016) find that family blockholding negatively impacts environmental performance in East Asia, while Hsu, Liang, and Matos (2019) find evidence of a positive relationship between government blockholding on environmental performance that occurs primarily in emerging markets. By investigating board renewal mechanisms alongside traditional governance mechanisms, we show that both types of governance changes matter independently. Equally important, we can make causal inferences from governance to environmental performance because of plausible exogenous shocks to board renewal mechanisms during our sample period.

Our paper also extends existing work that explores the performance implications of majority voting rules (e.g., Cunat, Gine, and Guadelupe, 2012; Ertimur, Ferri, and Oesch, 2013; Doidge et al., 2019) and female board participation (e.g., Adams and Ferreira, 2009; Adams and

[1] See, e.g., Hong and Kacperczyk (2009), Edmans (2011), Liang and Renneboog (2017), Hong and Liskovich (2017), Cronqvist and Yu (2017), Hart and Zingales (2017), Lins, Servaes, and Tamayo (2017).

Funk, 2012; Ahern and Dittmar, 2012; Kim and Starks, 2016a) by showing the impact of these governance structures for firms' environmental performance. Our findings on the positive impact of board renewal in family-controlled firms is particularly interesting for the literature on family control, which finds limited ability for governance to offset negative impacts of family ownership (e.g., Morck, Wolfenzon, and Yeung, 2005; Bennedsen, Nielsen, Perez-Gonzalez, and Wolfenzon, 2007; Lins, Volpin, and Wagner, 2013).

Finally, our findings have practical importance for investors, analysts, and academics interested in materiality—that is, which specific reporting items matter for both environmental and financial performance (e.g., Khan, Serafeim, and Yoon, 2016; Christensen, Hail, and Leuz, 2019). Our paper demonstrates that measured environmental performance is at least partly the result of prior governance choices, so any effort to define what is material when it comes to environmental performance should take into account the direct impact of governance.

2. Governance Mechanisms and Firms' Environmental Performance

Before turning to the empirical evidence, we develop hypotheses regarding connections between governance mechanisms and firms' environmental performance, building on the theoretical framework of Bénabou and Tirole (2010).[2]

Consider an investment choice to improve environmental performance, controlled either by an entrenched insider or by an outsider, that requires a current cash outlay for some long-term benefit. Bénabou and Tirole (2010) highlight two frictions that make the identity of the decision-maker relevant for environmental performance. First, insider short-termism can arise from well-known compensation and career concerns (e.g., Stein, 1989; Edmans, Gabaix, and Jenter, 2017; Flammer and Bansal, 2017), where managers place a disproportionate focus on current performance.[3] Second, insiders and outsiders can also receive non-pecuniary utility from

[2] The nuances they ascribe to overall CSR performance apply directly to the stand-alone environmental component of CSR.

[3] Short-termism also emerges when family owners are insiders, as family owners consume private benefits that similarly depend disproportionately on current cash flows (e.g., Kalcheva and Lins, 2007).

environmental investments, such as a 'warm halo' effect from endearing themselves to the community.

Entrenched insiders will choose a higher level of environmental performance than outsiders only if insiders have both negligible short-termism and place a higher value on the non-pecuniary benefits of environmental performance than outsiders (e.g., Masulis and Reza, 2015). Under these strong assumptions, better governance that conveys greater power to outside investors should lower firms' environmental performance. In all other cases, better governance increases firms' environmental performance. If insiders and outsiders value the non-pecuniary benefits similarly, better governance improves outsiders' control rights, allowing them to reduce insider short-termism. This positive impact of outsider control on environmental performance will be even greater when outsiders place a higher value on the non-pecuniary benefits from environmental investments than insiders. Notably, the resulting environmental investments are not necessarily NPV enhancing, as the outsiders have an incentive to seek overinvestment because of the weight they place on non-pecuniary factors.

3. Sample and Summary Statistics

3.1. Environmental Performance Variables

At the time of writing our paper no apparent market leader exists for ESG data. We choose the Thomson Reuters ASSET4 ESG database, since it offers the broadest coverage of large, publicly-traded firms worldwide, for the longest possible time series. ASSET4 analysts acquire information from annual reports, corporate sustainability reports, NGOs, and news sources, at annual frequency. It evaluates firms' environmental commitments in three areas: Emission Reduction, Resource Reduction, and Product Innovation. Within each area, ASSET4 analysts identify specific line items (e.g., "Are the firm's greenhouse gas emissions/sales below the industry median in that year?"), with 70 items in total. Consistent coverage of firms begins in 2004, with coverage for a few countries starting in 2009. We use data from the first year of coverage through

year-end 2015 for our analysis. All variable definitions and data sources are provided in Table A1 in the Appendix.

Perhaps the biggest concern with data from commercial vendors is the weighting scheme that they employ for the line items they collect, which is not transparent and may not give sufficient weight to real effects. Therefore, we take an empirical approach that helps to mitigate a concern that a particular proprietary weighting drives results. First, mimicking the approach of many institutional investors, we use ASSET4's aggregate environmental performance scores that they themselves weight and standardize. They claim their weighting choices emphasize line items that are material and thus of interest to investors.[4] However, since from an academic perspective there is no obvious weighting scheme, our second approach is to create our own equally-weighted environmental performance measure, which we construct from raw environmental data items. In addition, we build a materiality-weighted environmental score, in which we weight the raw environmental data items based on the materiality for that industry as determined by the Sustainability Accounting Standards Board (SASB). The SASB industry-based Materiality Map is, to our knowledge, the most comprehensive attempt yet to consider specifically those sustainability issues that are likely to affect the financial or operating performance of firms.[5]

The proprietary-weighted aggregate scores that ASSET4 provides to investors (ASSET4 *z*-Scores) are rank-based scores that range from 0 to 100 and measure the environmental performance relative to all other companies in a given year. For our equally-weighted measure, we first transform all line items into indicator variables such that a 'one' corresponds to better environmental performance (e.g., a below-median greenhouse gas emission firm would get a

[4] Note that Ferrell, Liang and Renneboog, (2016) and Dyck et al., (2019) also study a large international sample of firms and find that their empirical results are similar if they use alternative ESG data providers, such as Sustainalytics and Bloomberg, in place of ASSET4.

[5] The SASB classification was published in November 2018. We use the pre-publication online version as of December 2017 (see materialiy.sasb.org).

'one') and then sum up the indicator variables in each of the three environmental categories, divide by the number of available indicators, and take an average across the three areas to produce our equally-weighted aggregate environmental performance scores (see Appendix Table A2 for details).

We note here two things that are specific to environmental performance data. First, they differ from financial performance data in that disclosure is not mandatory, it is not required to be audited, and information may be missing. Second, despite this, strong investor pressure exists to produce these data and firms around the world are increasingly reporting against common standards and seeking external assurance that their environmental performance data are valid. For robustness, we explore in Appendix Table A3 whether missing data for environmental scores is important for our sample. We find that more than 70% of ASSET4's line items are available in each year and that these high reporting percentages are relatively stable over time and across countries. This suggests that inconsistent reporting is unlikely to drive our empirical results.

3.2. Governance Variables

ASSET4 provides a large number of governance line items and we use it as our primary source of data for governance mechanisms. We first employ an aggregate 'kitchen-sink' governance score based on almost 40 line items. Next, we measure governance using specific traditional governance mechanisms featured in the international corporate governance literature. Third, and most importantly, we measure contemporary governance mechanisms that 'renew' the thinking of the board and are of growing interest to investors and academics.

3.2.1. Aggregate Governance Score

ASSET4 classifies its governance line items into five categories: Board Functions, Board Structure, Compensation Policy, Shareholder Rights, and Vision and Strategy. The 'Vision and Strategy' line items, however, relate to a firms' sustainability choices—as such, we exclude these from our tests of the determinants of firms' environmental performance (e.g., "Is the company's

CSR report published in accordance with the GRI guidelines?").[6] As with our equally-weighted environmental performance metric, we convert the remaining 38 governance line items into indicator variables, take the average of all line items within each of the remaining four governance categories, and take the average across these category scores (see Appendix Table A4 for details). This ASSET4 Governance measure ranges from zero to one.

3.2.2. Traditional Governance Mechanisms

Outside investors will mostly or fully lack control rights when firms are owned and controlled by a family or other blockholder. Therefore, our first measure is whether a firm is blockholder controlled. It is challenging to systematically identify family and other blockholders across time in an international sample. We measure blockholder control by combining detailed firm-level ownership data from ASSET4, Datastream, Orbis (Bureau van Dijk), and the Global Family Business Index (obtained from Center for Family Business at the University of St. Gallen, Switzerland). We group all firms into three categories: firms controlled by a family, firms controlled by nonfamily blockholders, and widely held firms without a controlling blockholder (details of the process are in Appendix Table A1).

The controlling blockholder type that is most relevant for our study is whether a firm is family controlled because of short-termism concerns as discussed in Section 2. Ample evidence shows that private benefits for families come from current cash flows or cash holdings. Thus, family insiders will be less willing to use current cash to make potential value-enhancing investments, as such spending will limit their private benefits.[7]

[6] In addition, we exclude one line item from the 'Compensation' category (whether the firm has implemented sustainability compensation incentives).

[7] For example, markets put a lower value on corporate cash holdings when firms have entrenched insider/family control, indicating a fear that cash will be consumed for private benefits (Kalcheva and Lins, 2007). Similarly, transfer pricing schemes that involve trading between public companies overwhelmingly have private benefits created from current (rather than future) cash flows (Cheung, Rau, and Stouraitis, 2006; Desai, Dyck, and Zingales, 2007; Jiang, Lee, and Yue, 2010). Further, family-controlled firms have been shown to both underperform and be unwilling to make current investments particularly during periods where cash holdings are most valuable (Lemmon and Lins, 2003; Lins, Volpin, and Wagner, 2013).

Next, following Aggarwal, Erel, Stulz, and Williamson (2008), we construct a traditional governance index based on several governance mechanisms they argued, at that time, 'have received the most attention in the academic literature and from observers.' These mechanisms are Board Independence: the board has more than 50% independent directors; Board Size: the board has more than five members but less than sixteen; CEO/Chairman Separation: the roles of the CEO and chairman are separated; Board Structure: directors are elected individually (no staggered board); Audit Committee Independence: the audit committee is composed solely of independent directors; and Stock Classes: only one class of common stock (all shares have equal voting rights; no dual classes).[8] We obtain these data from ASSET4 and BoardEx.

We note that these traditional governance mechanisms rely in large part on an increased role for independent directors.[9] More recent research, however, points out that under existing arrangements for electing directors, independent directors are often co-opted by insiders. One reason for this is because independent directors are appointed by, or feel an obligation to, insiders (e.g., Shivdasani and Yermack, 1999; Coles, Daniel, and Naveen, 2014; Bebchuk and Hamdani, 2017).[10] Biases in decision making emphasized in the behavioral economics literature can compound this problem.[11] As an example, in boards subject to 'groupthink', the desire for unanimity both overrides 'their motivation to realistically appraise alternative courses of action' (Janis, 1972) and can cause group members to ignore ethical or moral consequences (Janis, 1971).

[8] We do not include a measure (Auditor Ratification: auditors are ratified at most recent annual meeting) that was in the Aggarwal et. al. (2008) index, as it is not available in ASSET4.

[9] This is obvious in the traditional governance index of Aggarwal et al. (2008). Three items explicitly focus on board independence (board has more than 50% independent directors, board has an independent Chair, audit committee is 100% composed of independent directors) and a number of the other items are related.

[10] As an example, Bebchuk and Hamdani (2017) state "these arrangements provide controllers with decisive power to appoint independent directors and decide whether to retain them, independent directors have significant incentives to side with the controller and insufficient countervailing incentives to protect public investors in conflicted situations" (p. 1274).

[11] See, for example, Tversky and Kahneman (1971, 1972), Shiller (1981), Barberis and Thaler (2003), Gennaioli and Shleifer (2010).

3.2.3. Contemporary Mechanisms of Board Renewal

One key component of our paper is that we go beyond traditional governance to explore the impact of contemporary governance mechanisms that plausibly renew the mindset of the board. As the opening paragraph of our paper points out—there appears to be a growing gap between outside investors and insiders on the importance of taking concrete actions to address environmental risks. With a large gap between the collective board attitude and the investors' attitude toward a policy, changing that policy likely requires stronger director incentives or changing the directors themselves. For example, replacing one or more board members is an important mechanism used by activists to change firm policies (e.g., Brav et al., 2008; Becht et al., 2017).

To achieve board renewal, Bebchuk and Hamdani (2017) note that investors have focused on three ways to refine the voting process for directors: nominating committees composed of independent directors, majority voting, and giving investors enhanced proxy access. Of these, we focus on the majority voting mechanism as we have available data around the world (from ASSET4), there is significant variation in the use of this mechanism across firms, and, as described in Section 4, we have variation across time in firm adoption of this mechanism driven by external factors and not environmental performance concerns.

Traditionally, in director elections the vote is for a slate of directors and shareholders could vote either 'for' or 'withhold' their vote (which was equivalent to not voting). In this voting system, all that is required is a plurality of votes, which means directors can get elected with a single yes vote. With majority voting rules, a board member needs to receive more than 50% of the votes cast, giving outside investors the ability to veto insiders' nominees for the board, and thus substantially more power over director elections. Around the world investors have been asking regulators, stock exchanges, as well as firms themselves to adopt majority voting policies. For our tests, Majority Election is an indicator variable that equals one if the company's board members are generally elected with a majority vote, and zero otherwise.

An alternative route to board renewal is to force board turnover. Doing so brings directors with new thinking more aligned with outside investors, and the injection of a new director's view can help overcome groupthink. Two ways to force board turnover are to introduce diversity requirements on boards and/or impose limits on board member tenure. Internationally, a significant example of forced board renewal are policies to increase female board representation.

Around the world, a large number of regulators and investors have pushed for more female involvement in a variety of ways including 'hard' measures such as regulatory mandates that specify gender quotas and 'soft' measures including regulatory initiatives demanding firms comply-or-explain against gender targets as well as investor coalition requests for enhanced female board representation. As Adams and Ferreira (2009) describe, this push stems from two beliefs, both related to governance: first, board quality will be improved by drawing from the broader talent pool that includes women; second, as they note "[…] because they do not belong to the 'old boys club,' female directors could more closely correspond to the concept of the independent director emphasized in theory" (p. 292).

There is evidence that increased female board representation significantly impacts governance. Adams and Ferreira (2009), for example, study US firms and find greater board attendance and a higher sensitivity of CEO turnover to financial performance when women are on the board. Among Norwegian firms, Ahern and Dittmar (2012) find that females added to the board are less likely than male board members to be insiders (and, thus, more independent), and have higher levels of education, are younger, and have less experience. Kim and Starks (2016a) focus on director skills sets in US firms and find that female directors bring skill diversity to the board, and in particular sets of expertise currently missing, one of which is corporate governance.[12]

[12] The evidence of the impact of adding females to the board and increasing board diversity on firm performance is mixed. Adams and Ferreira (2009), Ahern and Dittmar (2012), and Adams, Akyol, and Verwijmeren (2018) find negative effects, while others report positive impacts (e.g., Kim and Starks, 2016b, find diversity increases performance related to M&A decisions).

Finally, in some regression specifications we introduce an indicator that a firms' board has *not* been renewed, based on data on the average age and tenure of the board. In the UK, for example, when board members' tenure exceeds nine years, they are no longer considered independent and can no longer serve on key board committees such as the audit and compensation committees (UK Corporate Governance Code, 2016). Old age provides another plausible indicator of stale thinking. We combine these two indicators, categorizing boards as 'Old or Stale' using an indicator variable that equals one if either at least 50% of directors have tenure greater than nine years or at least 20% of the directors are over 70 years old, and zero otherwise. [13]

3.3. Final Sample and Descriptive Statistics

We obtain financial statement and stock market valuation data, institutional holdings, and US cross-listed status from Worldscope, Datastream, Factset Ownership, ADR lists, and CRSP as controls. Our final sample consists of 20,447 firm-year observations and covers 3,293 firms from 41 countries during the period 2004-2015.

In Panel A of Table 1 we report summary statistics for firms' environmental performance, governance mechanisms, and other characteristics. There is significant variation in firms' environmental performance and governance structures across countries, industries, and time. As we describe below, in all our tests we control for most of these sources of variation with fixed effects. Regarding firms' environmental performance, the average ASSET4 Environmental *z*-Score is 54.2 and the average Equally-weighted Environmental Score is 39.1, where a perfect score would be 100 for each of the two measures. Turning to the governance variables, 23% of our sample firms are controlled by a family. The average firm has 3.7 out of the 6 traditional governance mechanisms (i.e., more than 50% of the board is independent, separation of chair and CEO, etc.). Majority election is present in 55% of our sample firms and 60% of firms have at least one female board member.

[13] Unfortunately, we cannot construct a firm level measure capturing mandatory director term limits that could identify a stale board in our sample. Such mandatory tenure limits are infrequent and only present in 6.5% of our sample firms.

In Panel B of Table 1, we report average environmental performance and governance measures for our sample firms by country. To facilitate comparisons across countries, we report summary statistics for the cross-section in year 2012. The countries where firms have the highest environmental performance are all European (e.g., France, Finland, Spain, and Sweden are ranked in the top five for the two measures of environmental performance). Countries where firms' environmental scores are lowest are concentrated in Asia, Australia, and Africa. The four countries with the greatest fraction of family firms are Mexico, Portugal, Turkey and Russia, whereas family firms are relatively rare in Singapore, New Zealand, Japan, and Taiwan. Traditional Governance is strongest in Canada, UK, and Finland. More than 70% of firms domiciled in the UK, Canada, and Australia elect their directors with a majority vote, while no more than 40% of firms have such a rule in Japan, South Korea, and Egypt. In terms of female board members, all firms in Finland, Israel, Norway, and Sweden have at least one female board member, while less than 20% of firms do so in Japan and South Korea.

4. Does Better Governance Improve Firms' Environmental Performance?

4.1. Baseline Tests of the Impact of G on E

Our baseline tests in Table 2 examine the relation between corporate governance and firms' environmental performance using the following specification:

$$Log\left(Score_{it}\right) = \alpha + \beta' X_{it-1} + \gamma' Y_{it-1} + \Lambda + \varepsilon_{it}, \quad (1)$$

where the dependent variable is the log of one of the environmental scores of firm *i* in year *t*, X_{it-1} are measures of corporate governance in firm *i* in year *t-1*, Y_{it-1} are a set of firm-level controls in year *t-1*, and Λ are year, country, and industry fixed effects.[14] Our main variables of interest are

[14] Environmental variables reflect data available to ASSET4 analysts that covers the firm's fiscal year. A score for fiscal year 2010, for example, would reflect items that occurred during the 2010 fiscal year as well as information contained in the company annual report and any company sustainability reports published after the fiscal-year end early 2011. Thus, our baseline model with 2011 environmental scores would have fiscal-year-2010 right-hand-side variables.

the corporate governance measures. Given the importance of blockholder control, all specifications include the dummy variables Family and Other Blockholder control. In model 1 we test for the importance of governance using the catch-all ASSET4 Governance measure. In model 2 we use the traditional governance index of Aggarwal et. al. (2008). Models 3 through 5 include contemporary governance measures that capture different aspects of board renewal. Model 6 includes both the traditional governance index and contemporary governance measures.

We use logs of environmental scores to obtain better distributional properties and to reduce the impact of outliers.[15] For firm-level control variables we use firm size (log of assets), cash, asset tangibility, leverage, profitability, institutional ownership, and whether a firm is cross-listed on a major US stock exchange. We include firm size as prior literature has shown it to be related to ownership structures, and larger firms may be subject to more external pressures. Hong, Kubik, and Scheinkman (2012) suggest that financial slack also explains environmental adoption. Following them, we include cash, asset tangibility, and leverage to capture credit constraints, and profitability to capture the impact of performance. Cross-listing captures broad ownership and governance structures. Institutional ownership is included as Dyck, Lins, Roth, and Wagner (2019) find that institutional investors are a factor in environmental performance around the world. Given the substantial variation across countries, we include year-by-country fixed effects and year-by-industry fixed effects to ensure that any relation between environmental performance and corporate governance is identified both within country-year and within industry-year. We cluster standard errors by country.

The tests in Table 2 show a significant and economically important relationship between governance and firms' environmental performance. Panel A reports the results using ASSET4 Environmental *z*-Scores as the dependent variable. In model 1, we test for the importance of both the traditional governance measure of Family and Other Blockholder control, and the broadest

[15] Our main results are unaffected if we use the raw scores rather than the log scores. Our results are also similar when we use industryxcountry×year fixed effects though we lose 10% of the sample due to singleton observations.

overall governance measure, ASSET4 Governance. We find a negative and statistically significant (p-value < 1%) coefficient on Family.[16] The coefficient implies that when insiders are fully entrenched, as is the case in family-controlled firms, environmental performance levels are 10% below those in otherwise similar widely held firms. Conversely, the coefficient on ASSET4 Governance is positive and statistically significant (p-value < 1%). Considering this measure, a one standard deviation improvement in governance is associated with an increase in environmental performance of 11.5% (computed as 0.818 × 0.14).

The ASSET4 metric is a kitchen-sink measure that contains both traditional and contemporary governance mechanisms. To isolate the importance of traditional governance mechanisms, in model 2 we use the Aggarwal et. al. (2008) traditional governance index. Again, we find a positive and significant impact (p-value < 5%) of governance on environmental performance. The coefficient indicates that a firm that adds one additional traditional governance mechanism (e.g., separating the role of CEO and Chairman) is predicted to increase its environmental performance by 3.1%. In model 3 we get a sense of the importance of renewed thinking on the board for environmental performance. The coefficient on Old or Stale Board is negative and significant (p-value < 1%). Firms that do not have an old or stale board have a 7.8% higher environmental performance. In model 4 we assess the importance of providing outside investors with greater power over director selection through majority voting. The coefficient on Majority Election is positive and significant (p-value < 1%) showing that when investors have this power, firms have an 9.2% higher environmental performance. Finally, in model 5 we assess the importance of female board representation, which is a proxy for board renewal as it is often the result of both investor and societal pressures. The coefficient on Female Director is positive and significant (p-value < 1%) and indicates that adding one or more female board members to an all-male board would increase firms' environmental performance by 14.7%.

[16] We note that in this specification, the coefficient on Other Blockholder is significant at the 10% level. Because the coefficient is not significantly different from zero in any other specification in this or other tables, we do not emphasize it.

In model 6 of Table 2 we include the proxies of board renewal as measured by Majority Election and Female Director alongside the traditional governance index and blockholder control in one specification. These measures could be correlated and including them all in one specification helps us assess whether each measure has a unique impact on firms' environmental performance (or whether one measure dominates). The results show that all governance mechanisms have an independent and significant impact on firms' environmental performance. We find that when outsiders have greater control rights arising from the adoption of majority election provisions, environmental performance improves by 8.2%. Further tests, provided in the Appendix (Table A5), show a greater impact of female board membership on E performance when there are two or more female directors on the board.[17] Of particular interest, adopting the contemporary governance mechanisms of majority voting or additional female directors is estimated to improve environmental performance by three to five times as much as adopting one additional traditional governance mechanism.[18]

We use the Equally-weighted Environmental Score as our dependent variable in Panel B of Table 2. The Equally-weighted Environmental Scores help us to mitigate the concern noted earlier that commercial vendors aggregate environmental scores may not give sufficient weight to real effects. In constructing this score, we weight the line items in each of the three pillars equally and thus employ different weights than those used by ASSET4 in computing its *z*-Score. Nonetheless, we arrive at similar conclusions as to the importance of corporate governance for

[17] In models 1 and 3 of Table A5, we include an indicator variable equal to one when a firm has one female director, and another indicator variable for firms with more than one female director. As shown in Table 1, 31% of firms have one female director and 29% have two or more female directors. In models 2 and 4 we include the variable percentage of directors that are female. From model 1, firms with one female director have 11.4% higher E scores, while those with two or more female directors have 20.6% higher E performance. Both coefficients are significant at the 1% level. The positive and significant coefficient on the percentage of female directors in model 2 is also consistent with more female directors leading to greater firm E performance.

[18] We also address the possibility that an omitted variable, environmental controversies, drives both the appointment of the first female director and the improvement in environmental performance. As an example, Nike, Inc. faced considerable outside pressure with the global boycott campaign due to apparent human rights violations during the 1990s. In response, the firm significantly improved its ESG performance, including the appointment of a female board member. In unreported models, we test whether the appointment of a female director is related to prior-year environmental controversies (measured using ASSET4's environmental controversies indicators; see Appendix Table A2). We find no significant relationship, with *p*-values ranging from 0.39 to 0.95.

firm's environmental performance. As for the control variables, in both panels we find that larger firms, more profitable firms, and firms with greater tangibility show stronger environmental performance. Consistent with Dyck et al. (2019), firms with higher institutional ownership generally have better environmental performance.

The line items we use in constructing the equally-weighted score allow us to create a materiality-weighted environmental score focusing only on the line items SASB identifies as having a material impact on a firm's financial condition or operating performance. To that end, in model 7 of Panel B of Table 2, we introduce as a dependent variable a Material Environmental Score. This score is based on the ASSET4 line items that are material according the SASB Materiality Map, with materiality depending upon industry. Because not all industries in our sample have a mapping into the Materiality Map and not all line items in SASB can be matched to ASSET4, the sample size for these tests is reduced from 20,447 to 12,837 observations. We nonetheless find generally similar results, with family control, majority voting, and female director continuing to have a significant impact while the effect of traditional governance is no longer significant.

Because we obtain similar results using the alternative weights in the equally-weighted and SASB-weighted environmental scores, this increases our confidence that idiosyncratic weighting choices and standardization employed in the ASSET4 *z*-Score are not driving the finding that better corporate governance improves firms' environmental performance.

4.2. Firm Fixed Effects

To support a causal interpretation that corporate governance influences firms' environmental performance, we first introduce firm fixed effects specifications. These specifications control both for time-invariant unobservable firm characteristics, and as before, time-varying observable firm characteristics. For these tests, we keep only those observations where the governance variables are time-varying during the sample period. The premise in these tests is similar to that of prior studies of activist engagements in which an initial governance

improvement in a target firm facilitates a specific performance outcome (e.g., Becht et al., 2017). Such a within-firm specification is relatively demanding in terms of power as governance structures are generally sticky over time.

We report the results in Table 3 and they confirm our prior conclusions—when outsiders in a firm gain more control as a result of the introduction of better governance mechanisms, firms' future environmental performance improves. Not surprisingly, since firm heterogeneity is considerable in our sample, the implied economic impact is attenuated.

4.3. Renewable Governance Shocks

To further address causality, we seek exogenous shocks to corporate governance mechanisms that are not simultaneously shocks to firms' environmental performance. Specifically, board renewal mechanisms have the potential to provide such shocks, as in some countries in our sample either legislation or outside pressures forced adoption of majority voting rules or female board representation. There are no such shocks for family control and we could not find compelling exogenous shocks for the other governance mechanisms during our sample period.[19]

The most convincing test from a causal perspective comes from quotas that are mandated by legislation, and force some but not all firms to add female directors. The first such regulator-mandated female quota was introduced in Norway in 2003 (preceding our sample period). With a quota, firms are forced to add women to the board, independent of their beliefs regarding the importance of environmental performance. This allows one to cleanly examine whether the addition of one or more women to the board leads to subsequent improvements in environmental performance, by comparing the firms treated with the quota to those that were not (e.g., because they already had female board members).

[19] It is perhaps not surprising that we find no shocks to traditional governance mechanisms as Fauver, Hung, Li, and Taboada (2017) study performance changes after quasi-exogenous board reforms across 41 countries, but most of these major board reforms occurred in the late 1990s and early 2000s, which pre-dates our sample period.

Besides quotas, firms are also subject to pressures from large investor groups to change their governance by adding female directors. While these investor pressures do not come with a legislative mandate, they nonetheless are both a strong outside pressure and are focused specifically on gender representation (not on environmental performance). We label such pressures quasi-exogenous shocks. For example, in the UK, in 2011, Lord Davies published his Women on Boards review that made ten recommendations regarding disclosure and policies on diversity, including a recommendation that FTSE 100 firms should have 25% female board representation no later than the year 2015. The effort was supported by investor groups such as the Association of British Insurers which disclosed that it would now start monitoring female board representation.

The best country in our dataset to explore the impact of quotas is France. In 2011, the French government passed legislation establishing female board quotas: a 20% minimum for both sexes by January 1, 2014 and a 40% minimum by January 1, 2016. This was a hard quota, in that firms faced significant penalties if they failed to comply. The quota was imposed in the middle of our sample period, allowing us to analyze multiple years of environmental performance data both before and after the shock. In addition, there are a sizable number of firms from France in our dataset, allowing us to construct a treated group and a control group of sufficient size for empirical analysis in a single-country study. We define treatment as occurring for firms that had no female directors and thus needed to move quickly to elect women to the board to meet the minimum requirement. We define the control group as all other firms, a group that all had at least one female director, and for which many firms already exceeded the quota requirement for 2014. As expected, untabulated tests confirm that the treated group added a significantly greater percentage of female directors following the passage of the quota legislation.

In Figure 1 and Table 4 we test whether the imposition of the quota significantly increased environmental performance for the treated compared to the control firms. Panel A of Figure 1 shows plots of the ASSET4 Environmental *z*-Scores as well as the Equally-weighted Environmental Scores in the two years prior to the quota, and in the two years after the quota

imposition. We consider both 2011 and 2012 to be the treatment years because the mandate was not binding for three years and it plausibly takes time to appoint new directors. Comparing the pre and post periods, the two figures in Panel A show a more substantial increase in environmental performance for treated compared to control firms. Also of note, the figures provide no indication of significant differences in pre-trends for environmental performance across these two groups, with both groups increasing at a generally similar rate.

In Table 4 we show results using a difference-in-differences specification that compares changes in treated firms relative to changes in control firms. These tests mitigate the impact of other potentially confounding factors by limiting attention to a window centered around the quota event, by controlling for time-invariant firm characteristics with firm fixed-effects, and by controlling for time-varying firm characteristics using the same variables introduced in our prior regressions. We exclude any firms in which there was a change in family control, other-blockholder control, or cross-listing status to make sure the results are not driven by other major changes in the firm.

Models 1 and 2 of Panel A show that treatment increases environmental performance. Specifically, we find a positive and significant coefficient on the Post × Treated variable, which is an interaction of the treated-firm dummy with the Post-mandated-quota variable. In terms of economic significance, the effects on environmental performance of the mandated quota is sizable—a firm that had no woman on the board increases its environmental performance by 11% to 15% more than firms that already had women on the board in France following the imposition of the mandated quota. This economic magnitude is very similar to what we find in the Table 2 regressions. Because the addition of more female directors was mandated for treated firms, our results support a causal interpretation that the appointment of female directors leads to subsequent increases in firms' environmental performance.

Turning to the adoption of majority voting provisions, there are no similar legislated mandates. Fortunately, Canada provides a good example of an investor push that we can treat as a

quasi-exogenous shock that leads to majority voting adoption. As detailed in Doidge et al. (2019), the majority voting shock was the creation of the Canadian Coalition for Good Governance (CCGG), an investor group whose first major campaign was a demand for firms to adopt a majority voting policy to provide investors more power over director selection. Starting from a situation in which very few firms had majority voting in Canada, in 2005 and 2006 the CCGG contacted firms through letters and phone calls, requesting they adopt this governance change. Over the next two years, Doidge et al. (2019) report substantial increases in firm adoption and provide results that support a causal interpretation that majority voting adoption was driven by the CCGG. Of crucial importance for identification, at this time Doidge et al. (2019) document that in none of the CCGG investor group private engagements with firms did they request that firms increase their environmental performance.[20]

We test whether this shock that increased majority voting adoption leads to subsequent increases in firms' environmental performance. As with the France board-gender shock, we first provide a figure to compare changes in environmental performance of the group of firms treated by the majority voting shock compared to a control group. We define treated firms as those that adopted majority voting either in 2006 or 2007, and control firms as those that did not change their majority voting policy during the 2004 to 2008 period. We then turn to a regression framework that uses a difference-in-differences specification spanning the 2004 to 2008 period, that is, two years before and two years after the initiative to push firms to adopt majority voting policies. Control firms capture any secular trend to increase environmental performance. We require that treated and control firms have at least one observation before and after the adoption years and drop the year of the initiative (2006). Further, to make sure the results are not driven by other major changes in the firm, we exclude any firms in which there was a change in family control, other-

[20] The first public indication the investor group took in environmental engagement was a process that began more than a decade later in 2016, to develop E&S guidelines, published in 2018, outside of our sample period https://www.ccgg.ca/wp-content/uploads/2019/01/The-Directors-ES-Guidebook-2018.pdf.

blockholder control, or cross-listing status. All specifications include firm fixed effects to control for time-invariant firm characteristics.

Panel B of Figure 1 shows that, post-treatment, treated firms have larger increases in E performance than control firms. Importantly, the figure also shows that both the treated and control groups are improving their environmental scores at a generally similar rate in the pre-treatment-period, consistent with a parallel trends assumption.

Models 3 and 4 of Panel A of Table 4 show that treatment via the adoption of majority voting increases E performance. Again, we find a positive and significant coefficient on the Post × Treated interaction variable. In terms of economic significance, the effects on environmental performance of the plausibly exogenous change in majority voting is large—firms that adopt majority voting increase their environmental performance by 21% to 40%. Again, these results support a causal interpretation that the adoption of majority voting rules that increase investor power in director elections lead to subsequent increases in firms' environmental performance.

The results from France and Canada are compelling, but of course have inherent limitations due to their smaller sample sizes and the fact that these shocks occur in just two countries. To increase confidence that these results are generalizable in nature, we next search for similar exogenous shocks or pressures for improved governance across all countries in our sample. We find examples in nine countries of exogenous pressures for female board representation and detail these examples in Table A6. These examples include some legislated mandates very similar to hard quotas with penalties introduced in France, other softer quotas that are less binding, as well as quasi-exogenous shocks coming from investor group pressure. Unfortunately, we do not find similar shocks for majority voting aside from the Canadian example just discussed. With these female board representation shocks from multiple countries we conduct similar difference-in-differences analysis.

We present this multiple-country evidence in Panel B of Table 4. Models 1 and 2 focus exclusively on the seven countries that legislated a quota for female board representation. Models

3 and 4 additionally include Germany and the UK where the shock was not legislation but rather substantial pressure from large investor groups to change their governance by adding female directors in 2011. The empirical approach is the same as in the France single-country example. We define treated firms as firms without female board representation prior to the mandate and control firms as firms that already have an at least one woman on the board. We include firm and year fixed effects, as well as all controls from the previous specifications. Standard errors are clustered by country.

Our results show that the causal effect found in France is generalizable across a larger set of countries. Again, we find a positive and significant coefficient on the Post × Treated interaction variable. In terms of economic significance, in models 1 and 2 we find that a treated firm—one that had no women on the board prior to the legislated quota—increases its environmental performance post quota by 6% to 9% more than control firms that already had women on the board prior to the quota. Results are virtually identical with the larger sample of seven countries in models 3 and 4.

Overall, the firm fixed effect regressions and the tests featuring country-level shocks to renewable governance mechanisms each support a directional interpretation—that is, G drives E.

5. Does Governance Matter Where Environmental Performance is More Salient?

In this section, we conduct additional tests to understand whether the relationship between G and E holds in settings where environmental risks are likely more salient. We first focus on countries that are expected to have, or actually do have, weaker environmental performance and thus the benefit of improvement is greatest. Next, we investigate family firms as these have significantly weaker environmental performance. Third, we test whether governance matters for specific components of environmental performance. Finally, we examine the impact of governance in subsets of industries identified as 'dirty.'

5.1. Countries with Weak Environmental Performance

In Table 5, we report results of our baseline tests, using three procedures to split countries into those that have low or high expected or actual environmental performance. We focus on countries with low performance. In these countries, risks are most salient and the scope for improvement is the largest. At the same time, however, sustainability-oriented investors will need to overcome local societal norms that place little emphasis on environmental improvement. Panel A presents results using the ASSET4 *z*-Scores and Panel B for the equally-weighted scores.

First, in models 1 and 2, we provide a simple split based exclusively on the firms in our sample and their country-level average environmental scores. Next, in models 3 and 4, we split countries based on their Environmental Performance Index (EPI) score, using the median country splits introduced in Dyck et. al. (2019). The EPI measures a country's overall environmental performance (i.e., not based solely on firms in the ASSET4 sample), and will be stronger in countries where there is greater environmental regulation and/or stronger societal attitudes towards improving the environment. These data are obtained from the Yale Center for Environmental Law, Yale University, and the Center for International Earth Science Information Network, Columbia University. Finally, in models 5 and 6, we compare countries outside of Continental Europe with Continental European counties. Environmental social norms are relatively stronger in Continental Europe.[21] Norms regarding the environment arguably provide a measure of the magnitude of non-pecuniary benefits towards the environment in the Benabou and Tirole (2010) framework.

The results we are most interested in are the coefficients on the governance variables in models 1, 3, and 5, that feature firms from countries with low environmental performance. As is to be expected, the coefficient on family control is strong and negative as in our baseline tests. Of more interest are the coefficients on the traditional and contemporary governance variables. Do

[21] Barber, Morse, and Yasuda (2019) report for Europe a stronger preference for investments that generate 'impact,' consistent with higher European values towards externalities on the Hofstede (2011) cultural dimensions of having a collective agenda versus individualistic agenda, having a long term view of society, and having more restraint versus being indulgent. Dyck et. al. (2019) conduct a similar Europe vs. other countries split.

sustainability-oriented investors have a chance, through better governance, to improve environmental performance when both insider short-termism *and* societal norms that place little emphasis on the environment are against doing so? The answer is 'yes.'

Across models 1, 3, and 5, we find strong and significant positive coefficients for the contemporary governance mechanisms—majority voting and having a female director. The coefficients on Traditional Governance are also positive and statistically significant with *p*-values less than 10%. Thus, taken together, our tests show that better governance generates environmental returns in the challenging settings where both environmental risks are most pronounced, and societal norms tolerate low environmental performance. This is particularly true for governance mechanisms that are aimed at renewing the mindset of the board.

Also of interest, the coefficients in models 2, 4, and 6 show that in settings where environmental risks are arguably not as severe, there is still some evidence that contemporary governance matters, generally with lower magnitudes and significance levels.

5.2. Entrenched Family Control

Our prior tests have shown that family control is negatively related to firms' environmental performance around the world. Given that 23% of our sample firms are family controlled, sustainability-minded investors who want to move the needle on environmental performance should be interested in whether governance mechanisms are also effective in family firms.

To address this question, we specifically examine the impact of governance in family firms and compare it to the impact of governance in nonfamily-controlled firms. To this end, we re-estimate model 6 of Table 2 and include interactions between Family and the governance mechanisms Traditional Governance, Majority Elections, and Female Director.

Table 6 reports the results of each governance measure for family firms as well as for nonfamily-controlled firms (Widely Held/Other). For family-controlled firms, the reported numbers are the sum of the coefficient estimates for a particular governance measure and its interaction with Family. For the nonfamily-controlled firms, the reported coefficients of a

particular governance measure are equal to the coefficient estimate on the stand-alone governance variable.

In both models 1 and 2, we find that better governance as measured by the traditional governance index does not impact the environmental performance of family-controlled firms. We also find that family firms with majority voting do not have better environmental performance. These two results are perhaps not surprising. Family firm insiders likely have enough voting rights to effectively have full control of the firm and its board. That is, family firm insiders likely control enough votes to allow them to get their 'family-friendly' directors elected even under a majority voting rule. However, governance does matter when it comes to board renewal as measured by having a female director—family firms with a female director have significantly higher environmental performance (p-value < 1%). In fact, the model 1 coefficient implies that a female director improves the environmental performance of a family firm by 12.4%, an impact almost identical to that in our baseline specification on the full sample of firms in Table 2, model 6. This is consistent with female board members, who are more likely new to the board, being less prone to 'local' thinking of established board members, and potentially having other preferences. We discuss this below in Section 7.

Turning to the bottom half of the table, the results show that both traditional and contemporary governance mechanisms have strong and significant impacts on widely held/other firms, which is expected given the results in Table 2.

5.3. Specific Categories of Environmental Performance Measures

Next, we test whether governance matters for specific components of environmental performance. In models 1 through 6 of Table 7 we use as dependent variables the environmental performance scores from the three ASSET4 categories—Emission Reduction, Resource Reduction, and Product Innovation—that constitute the two aggregate environmental performance measures (see Table 1). One might argue, for example, that reducing emissions and resources used in the production process of a firm are more material for investors than product innovation.

We find that governance mechanisms matter for environmental performance for all environmental category scores, with coefficients similar in magnitude and significance as those from the baseline specification. Our interpretation is that the strong impact we find of corporate governance on environmental performance applies very broadly and is not concentrated in specific environmental performance categories.

5.4. 'Dirty' Industries

Environmental performance improvement should be more salient in industries with higher levels of environmental impacts. Accordingly, in this section we focus on the impact of governance for environmental outcomes in plausibly 'dirty' industries. In these industries, improving environmental performance is likely to be the most costly and insider short-termism problems are therefore likely to be substantial. We use two different criteria to split the industries. First, we use the ASSET4 Environmental *z*-Scores, categorizing as dirty the five SIC Divisions (out of 9) that have the lowest average environmental scores. These SIC Divisions are Agriculture, Forestry, Fishing; Mining; Services; Retail Trade; and Wholesale Trade. Second, we define dirty industries more narrowly using the SASB categorization of industries by the degree to which environmental performance scores are material. Dirty industries, according to SASB standards, include the SIC Divisions Agriculture, Forestry, Fishing; Mining; and Services. Panel A of Table 8 details the mapping and summary statistics by SIC Division, and shows significant differences across industries in firms' environmental performance.[22]

Using the broad categorization of industries that are dirty, model 1 of Panel B shows that family control and contemporary governance mechanisms continue to significantly impact environmental performance in dirty industries, and model 3 shows that traditional governance also has a significant impact. We find the governance impact to be more muted when we use a narrow

[22] Note that family-controlled firms are not concentrated in 'dirty' industries (using the broad classification, families account for 23% of firms in 'dirty' industries and 22% in 'clean' industries). This helps to address a potential concern that the lower environmental performance of family firms that we have reported is a result of families choosing to control firms in 'dirty' industries rather than 'clean' ones.

categorization of industries deemed to be dirty. In this smaller sub-sample, the coefficients on all governance variables are generally similar but are only significant for the female director indicator. This result could stem either from entrenched insiders being more reluctant to listen to outsiders' requests for environmental performance when the short-term costs of improving environmental performance are likely to be high, or from a lack of power.

Overall, the tests in this section show that G affects E where environmental risks are likely more salient, with family control and having a female board member being important in all cases.

6. Director Characteristics, Board Renewal, and Improved Environmental Performance

In this section, we explore in detail the extent to which director characteristics account for the observed effects of board renewal improving firms' environmental performance. We first consider our result that majority voting rules, which increase investor power in director elections, lead to greater environmental performance. The adoption of majority voting rules could make existing directors care more about investors' interests, and/or it could lead to the introduction of directors with characteristics that correlate positively with a commitment to environmental performance (e.g., age, experience, and education).

Second, we consider the positive impact of female board representation on firms' environmental performance. This result could be driven by gender itself, and/or it could be obtained because a new female director has characteristics associated with greater concern for the environment. Ahern and Dittmar (2012), for example, document in their sample that compared to existing male directors, new female directors have significantly less CEO experience, are younger, and are more highly educated. Further, they find that after controlling for these characteristics, there is no longer a robust relationship between female board membership and firm performance. Alternatively, it is possible that gender has a unique stand-alone effect. Behavioral economics research shows that women in general (not specifically female board members) have stronger 'other regarding' preferences than men, such as a concern for the environment (e.g., Andreoni and Vesterlund, 2001; Adams and Funk, 2012; Thaler, 2016; Cronqvist and Yu, 2017).

In Table 9 we estimate regression models that include director characteristics for each firm for each year. If firms that adopt majority voting or appoint a female director exhibit systematically different board characteristics, which in turn are related to environmental performance, those characteristics should subsume the direct effect of the change in governance. For these tests we obtain director characteristics data for each director in our sample from BoardEx. Following Ahern and Dittmar (2012), we explore six director characteristics: whether the director has CEO experience; if the director has a higher education degree other than an MBA; if the director has an MBA degree; director age; tenure as a board member; and whether the director shares a last name with someone else on the board (a rough measure of whether a firm has family members on the board). We then aggregate the director characteristics at the firm-year level. The requirement to have board characteristic data from BoardEx lowers the sample size from 20,447 to 15,874 observations.

In models 1 and 6, we re-estimate the baseline regression from model 6 of Table 2 for the smaller BoardEx sample and find virtually identical results that introducing mechanisms of board renewal improve firm E performance. In models 2 and 7 we explore the impact of board characteristics alone, without the governance variables. We find that greater board-level CEO experience and attainment of higher education other than an MBA are associated with significantly stronger environmental performance. None of the other board characteristics matter for environmental performance. In models 3 and 8, by including governance mechanisms along with firm-level board characteristics, we can assess whether board characteristics or governance mechanisms themselves, or both, are behind the improved environmental performance. Our focus is on the coefficients on the renewable governance mechanisms of majority voting and female directors.

We find that the board characteristics do not in any way subsume the stand-alone renewable governance mechanism effect. Results are similar regardless of whether we focus on ASSET4 z-Scores or equally-weighted scores. For example, comparing model 3 relative to model 1, the

coefficient on majority voting is virtually identical (0.074 versus 0.075) and retains its level of statistical significance. The coefficient on female director also retains its statistical significance and is actually slightly larger in magnitude (0.152 versus 0.146). These results suggest that majority voting improves E performance by changing the incentives for directors to consider investors' concerns, and that female directors affect E performance for reasons related specifically to their gender.

We explore the female result further by comparing newly-hired female directors to newly-hired male directors. Similar to Ahern and Dittmar (2012), in our international sample female directors have less CEO experience, are more educated, are younger, and less frequently share a last name with someone else on the board.[23] Female directors have lower CEO experience which all else equal would predict lower E performance, and simultaneously have higher education which would all else equal predict greater E performance. Thus, our result that controlling for board characteristics does not change the coefficient or significance of having a female director is consistent with these characteristics having offsetting effects.

We further explore whether gender itself is a fundamental factor in models 4 and 5, and 9 and 10. Because more CEO experience and higher education other than an MBA are associated with higher E performance, we focus specifically on those female directors that have *low* levels of CEO experience and *low* levels of higher education. We use 'Low' ('High') indicator variables that are equal to one if a female director has CEO experience or higher education equal to or lower (higher) than the average of all other board members in that firm in that year, and zero otherwise. If CEO experience and higher education drive the results, gender should have no direct impact for female directors with relatively low levels of either of these. In all of these models we find a positive and strongly significant coefficient on the *Low* CEO experience indicator and the *Low*

[23] The reported differences are statistically significant controlling for industry, year, and country, with the following *p*-values: CEO experience (0.111), have higher education degree other than an MBA (0.058), have MBA (0.026), age (0.207), share same last name (0.078). We do not find a significant difference in previous board tenure. The differences are even greater if we compare newly-hired female board members to existing male board members (rather than newly-hired male board members).

higher education indicator. This indicates that a female director, independent of her other characteristics, strongly influences a firm's environmental performance. Based on extant research, this female effect could arise from any of three broad reasons: female directors have strong innate preference for other-regarding behavior, female directors as new board members shake up groupthink, or female directors bring new corporate governance skills. Unfortunately, existing international board data do not yet allow us to differentiate between these explanations.[24]

7. Conclusion

With a large gap between the collective board attitude and investors' attitude toward environmental risks, to change firm policies investors may need not only 'traditional' governance but also 'contemporary' governance mechanisms that plausibly renew the mindset of the board. We test for the importance of both of these governance channels in a large cross-country sample.

Our tests show that corporate governance drives firms' environmental performance. We find that family firms have weaker environmental performance. Also, firms with well-established traditional governance mechanisms, such as board independence or the separation of the roles of CEO and Chairman, demonstrate stronger environmental performance. We find the greatest improvement in environmental performance when investors are able to renew the mindset of the board by adopting contemporary governance mechanisms. Based on our regression models, firms that adopt a majority director election provision or add one or more female directors on the board improve firms' environmental performance by three to five times as much as adopting an additional traditional governance mechanism.

These findings, that investor power leads to improved environmental performance, are consistent with a view that firms improve E because investors are asking for it. The theoretical framework suggests this push comes from investors constraining insider short-termism and/or from investors putting a high value on non-pecuniary benefits from E investments.

[24] For example, outside the US firms are rarely required to disclose detailed director-specific skill sets similar to those required under Regulation S-K rules since 2009 (see, e.g., Adams, Akyol, and Verwijmeren, 2018).

The results in this paper have important implications for institutional investors that want to push firms towards improving their environmental performance. They provide a roadmap which suggests that these investors should not focus on aggregate measures of ESG, or even E as a stand-alone measure. Instead, they should focus on improving governance mechanisms first, since doing so contributes to improvements in firms' environmental (E) performance. And, in particular, investors should focus on any mechanism that is capable of renewing the mindset of the board.

The significant differences in the power of contemporary governance mechanisms compared to traditional ones when we examine firms' environmental performance may be useful for future research. Conclusions drawn in the governance literature have almost exclusively focused on traditional governance such as director independence. Given our results, it would be interesting to see how previously-studied corporate policies are impacted by contemporary governance mechanisms.

References

Adams, Renée B., and Daniel Ferreira, 2009, Women in the boardroom and their impact on governance and performance, *Journal of Financial Economics* 94, 291-309.

Adams, Renée B., and Patricia Funk, 2012, Beyond the glass ceiling: Does gender matter? *Management Science* 58, 219-235.

Adams, Renée B., Ali Akyol, and Patrick Verwijmeren, 2018, Director skill sets, *Journal of Financial Economics* 130, 641-662.

Aggarwal, Reena, Isil Erel, René Stulz, and Rohan Williamson, 2008, Differences in governance practices between US and foreign firms: Measurement, causes, and consequences. *Review of Financial Studies* 22, 3131-3169.

Ahern, Kenneth R., and Amy K. Dittmar, 2012, The changing of the boards: The impact on firm valuation of mandated female board representation, *Quarterly Journal of Economics* 127, 137-197.

Andreoni, James, and Lise Vesterlund, 2001, Which is the fair sex? Gender differences in altruism, *Quarterly Journal of Economics* 116, 293-312.

Barber, Brad M., Adair Morse, and Ayako Yasuda, 2018, Impact investing, Working paper, University of California, Davis.

Barberis, Nicholas, and Richard Thaler, 2003, A survey of behavioral finance, *Handbook of the Economics of Finance* 1, 1053-1128.

Bebchuk, Lucian A, and Assaf Hamdani, 2017, Independent Directors and Controlling Shareholders, *University of Pennsylvania Law Review* 165, 1271-1315.

Becht, Marco, Julian Franks, Jeremy Grant, and Hannes F. Wagner, 2017, Returns to hedge fund activism: An international study, *Review of Financial Studies* 30, 2933-2971.

Bénabou, Roland, and Jean Tirole, 2010, Individual and corporate social responsibility, *Economica* 77, 1-19.

Bennedsen, Morten, Kaspar Neilsen, Franciso Perez-Gonzalez, and Daniel Wolfenzon, 2007, Inside the family firm: The role of families in succession decisions and performance, *Quarterly Journal of Economics* 122, 647-691.

Brav, Alon, Wei Jiang, Frank Partnoy, and Randall Thomas, 2008, Hedge fund activism, corporate governance, and firm performance, *Journal of Finance* 63, 1729-1975.

Cheung, Y.L., P.R. Rau, and Aris Stouraitis, 2006, Tunneling, propping, and expropriation: Evidence from connected party transactions in Hong Kong, *Journal of Financial Economics* 82, 343-386.

Christensen, Hans Bonde, Luzi Hail, and Christian Leuz, 2019, Economic analysis of widespread adoption of CSR and sustainability reporting, Working paper, University of Chicago.

Coles, Jeffrey, Naveen Daniel, and Lalitha Naveen, 2014, Co-opted boards, *The Review of Financial Studies* 27, 1751-1796,

Cronqvist, Henrik, and Frank Yu, 2017, Shaped by their daughters: Executives, female socialization, and corporate social responsibility, *Journal of Financial Economics* 126, 543-562.

Cunat, Vicente, Mireia Gine, and Maria Guadalupe, 2012, The vote is cast: The effect of corporate governance on shareholder value, *Journal of Finance* 67, 1943-1977.

Desai, Mihir, Alexander Dyck, and Luigi Zingales, 2007, Theft and taxes, *Journal of Financial Economics* 84, 591-623.

Dimson, Elroy, Oğuzhan Karakaş, and Xi Li, 2015, Active ownership, *Review of Financial Studies* 28, 3225-3268.

Deloitte, 2017, Women in the boardroom, Fifth Edition.

Doidge, Craig, Alexander Dyck, Hamed Mahmudi, and Aazam Virani, 2019, Collective action and governance activism, *Review of Finance* 23, 893-933.

Dyck, Alexander, Karl Lins, Lukas Roth, and Hannes Wagner, 2019, Do institutional investors drive corporate social responsibility? International evidence, *Journal of Financial Economics* 131, 693-714.

Edmans, Alex, 2011, Does the stock market fully value intangibles? Employee satisfaction and equity prices, *Journal of Financial Economics* 101, 621-640.

Edmans, Alex, Xavier Gabaix, and Dirk Jenter, 2017, Executive compensation: A survey of theory and evidence, In: *Handbook of the Economics of Corporate Governance*, Chapter 9, 383-539.

El Ghoul, Sadok, Omrane Guedhami, He Wang, and Chuck C.Y. Kwok, 2016, Family control and corporate social responsibility, *Journal of Banking and Finance* 73, 131-146.

Ertimur, Yonca, Fabrizio Ferri, and David Oesch, 2013, Shareholder votes and proxy advisors: Evidence from say on pay, *Journal of Accounting Research* 51, 951-996.

Fauver, Larry, Mingyi Hung, Xi Li, and Alvaro G. Taboada, 2017, Board reforms and firm value: Worldwide evidence, *Journal of Financial Economics* 125, 120-142.

Ferrell, Allen, Hao Liang, and Luc Renneboog, 2016, Socially responsible firms, *Journal of Financial Economics* 122, 585-606.

Flammer, Caroline, and Pratima Bansal, 2017, Does a long-term orientation create value? Evidence from a regression discontinuity, *Strategic Management Journal* 38, 1827-1847.

Gennaioli, Nicola, and Andrei Shleifer, 2010, What comes to mind, *Quarterly Journal of Economics* 125, 1399-1433.

Hermalin, Benjamin, and Michael Weisbach, 1998, Endogenously chosen boards of directors and their monitoring of the CEO, *American Economic Review* 88, 96-118.

Hermalin, Benjamin, and Michael Weisbach, 2003, Boards of directors as an endogenously determined institution: A survey of the economic literature, *Federal Reserve Bank of New York Economic Policy Review* 9, 7-26.

Hart, Oliver, and Luigi Zingales, 2017, Companies should maximize shareholder welfare not market value, *Journal of Law, Finance, and Accounting* 2, 247-274.

Hofstede, Geert, 2011, Dimensionalizing cultures: The Hofstede model in context, *Online Readings in Psychology and Culture* 2, 8.

Hong, Harrison, and Marcin Kacperczyk, 2009, The price of sin: The effects of social norms on markets, *Journal of Financial Economics* 93, 15-36.

Hong, Harrison, Jeffrey Kubik, and Jose Scheinkman, 2012, Financial constraints on corporate goodness, Working paper, Columbia University.

Hong, Harrison, and Inessa Liskovich, 2017, Crime, punishment and the value of corporate social responsibility, Working paper, Princeton University and University of Texas.

Hsu, Po-Hsuan, Hao Liang, and Pedro Matos, 2018, Leviathan Inc. and corporate environmental engagement, ECGI Working Paper Number 526/2017.

Janis, Irving L., 1971, Groupthink, *Psychology Today*, 43-46.

Janis, Irving L., 1972, Victims of Groupthink: A Psychological Study of Foreign Policy Decisions and Fiascoes, Boston: Houghton Mifflin Company.

Jiang, Guohua, Charles Lee, and Heng Yue, 2010, Tunneling through intercorporate loans: The China experience, *Journal of Financial Economics* 98, 1-20.

Kalcheva, Ivalina, and Karl Lins, 2007, International evidence on cash holdings and expected managerial agency problems, *Review of Financial Studies* 20, 1087-1112.

Khan, Mozaffar, George Serafeim, and Aaron Yoon, 2016, Corporate sustainability: First evidence on materiality, *Accounting Review* 91, 1697-1724.

Kim, Daehyun, and Laura Starks, 2016a, Gender diversity on corporate boards: Do women contribute unique skills? *American Economic Review* 106, 267-271.

Kim, Daehyun, and Laura Starks, 2016b, Board heterogeneity of expertise and firm performance, Working paper, University of Texas at Austin.

Krueger, Philipp, 2015, Corporate goodness and shareholder wealth, *Journal of Financial Economics* 115, 304-329.

Lemmon, Michael L., and Karl Lins, 2003, Ownership structure, corporate governance, and firm value: Evidence from the East Asian financial crisis, *Journal Finance* 58, 1445-1468.

Liang, Hao, and Luc Renneboog, 2017, On the foundations of corporate social responsibility, *Journal of Finance* 72, 853-909.

Lins, Karl, Henri Servaes, and Ane Tamayo, 2017, Social capital, trust, and firm performance: The value of corporate social responsibility during the financial crisis, *Journal of Finance* 72, 1785-1823.

Lins, Karl, Paolo Volpin, and Hannes Wagner, 2013, Does family control matter? International evidence from the 2008-2009 financial crisis, *Review of Financial Studies* 26, 2583-2619.

Masulis, Ronald W., and Syed Walid Reza, 2015, Agency problems of corporate philanthropy, *Review of Financial Studies* 28, 592-636.

Morck, Randall, Daniel Wolfenzon, and Bernard Yeung, 2005, Corporate governance, economic entrenchment, and growth, *Journal of Economic Literature* 43, 655-720.

Shiller, Robert J., 1981, Do stock prices move too much to be justified by subsequent changes in dividends? *American Economic Review* 71, 421-436.

Shivdasani, Anil, and David Yermack, 1999, CEO involvement in the selection of new board members: An empirical analysis, *Journal of Finance* 54, 1829-1853.

Stein, Jeremy C., 1989, Efficient capital markets, inefficient firms: A model of myopic corporate behavior, *Quarterly Journal of Economics* 104, 655-669.

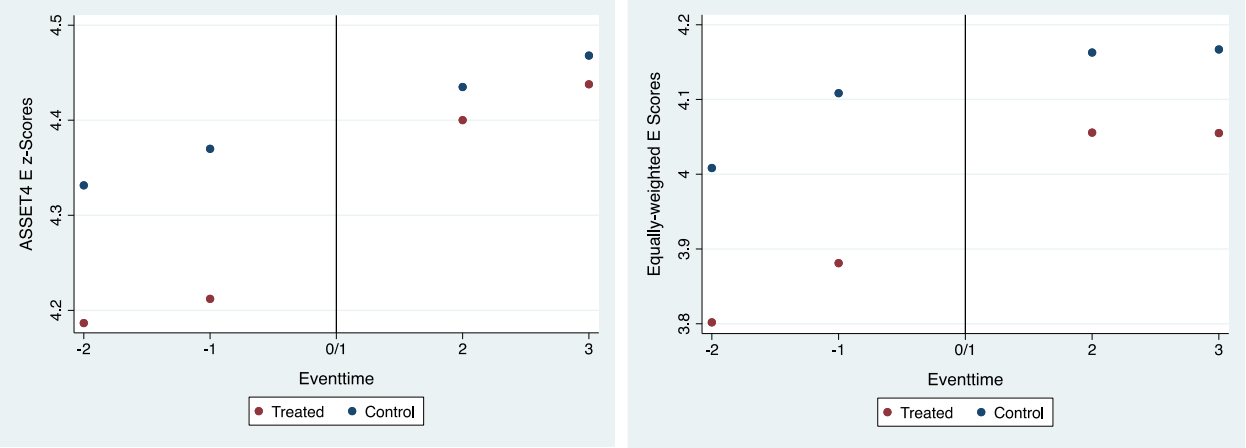
Thaler, Richard H., 2016, Behavioral economics: Past, present, and future, *American Economic Review* 106, 1577-1600.

Tversky, Amos, and Daniel Kahneman, 1973, Availability: A heuristic for judging frequency and probability, *Cognitive Psychology 5*, 207-232.

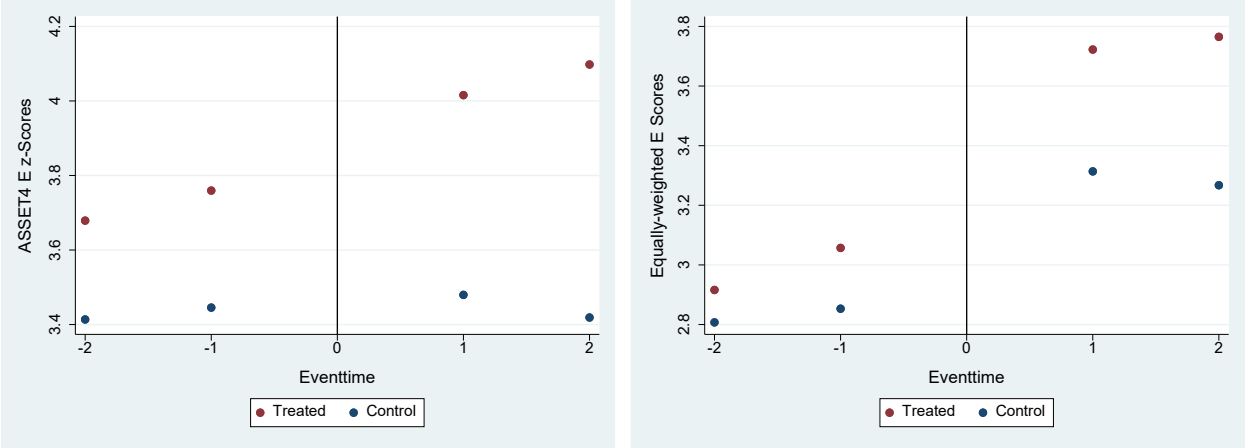
Tversky, Amos, and Daniel Kahneman, 1974, Judgment under uncertainty: Heuristics and biases, *Science 185*, 1124-1131.

Figure 1
Shocks and Environmental Performance: Single-Country Plots

This figure shows the trends of the ASSET4 Environmental z-Score and the Equally-weighted Environmental Score for years surrounding quotas for female board representation in France and a quasi-exogenous shock to majority director election rules in Canada. Both figures plot the average environmental scores for the treated firms and control firms in the two year prior to and after the outside shocks. In Panel A treated firms are firms that had no female board member at the end of 2010 and the control firms that already had female board members (treatment years: 2011/12). In Panel B treated firms adopt majority voting in 2006 or 2007; control firms do not change majority voting policies during the 2004 to 2008 period (treatment year: 2006).



Panel A: Quotas for Female Board Representation in France



Panel B: Majority Director Election Rules in Canada

Table 1
Descriptive Statistics

This table shows descriptive statistics of environmental scores, measures of corporate governance, and other key variables. Panel A shows summary statistics for the full sample. Panel B shows country averages for the year 2012 and the number of observations for the year 2012 and the full sample. The sample period is 2004-2015. All variables are winsorized at the 1st and 99th percentiles. All variables are described in Appendix Table A1.

Panel A: Summary Statistics

Variable	Mean	Median	SD	Obs
A. Environmental Performance Measures				
ASSET4 Environmental *z*-Score	54.2	57.6	31.2	20,447
Equally-weighted Environmental Score	39.1	36.8	21.2	20,447
Material Environmental Score	32.2	29.8	23.9	12,917
B. Governance Mechanisms				
Family	0.225	0.000	0.418	20,447
ASSET4 Governance	0.559	0.567	0.140	20,447
Traditional Governance	3.650	4.000	1.431	20,447
Board Independence	0.465	0.000	0.499	20,447
Board Size	0.840	1.000	0.367	20,447
CEO-Chairman Separation	0.656	1.000	0.475	20,447
Board Structure	0.331	0.000	0.470	20,447
Audit Committee Independence	0.615	1.000	0.487	20,447
Stock Classes	0.745	1.000	0.436	20,447
Old or Stale Board	0.193	0.000	0.395	17,366
Majority Election	0.548	1.000	0.498	20,447
Female Director	0.596	1.000	0.491	20,447
One Female Director	0.310	0.000	0.462	20,447
Two+ Female Directors	0.286	0.000	0.452	20,447
Percent Female Directors	0.103	0.091	0.111	20,447
C. Other Variables				
Log(Total Assets)	8.671	8.561	1.810	20,447
Cash	0.126	0.088	0.125	20,447
Tangibility	0.308	0.255	0.261	20,447
Leverage	0.236	0.221	0.173	20,447
Profitability	0.056	0.051	0.086	20,447
Other Blockholder	0.067	0.000	0.249	20,447
Institutional Ownership	0.241	0.197	0.176	20,447
Cross-list	0.109	0.000	0.311	20,447

Panel B: Summary Statistics by Country

Country	Environmental Scores		Governance Variables						Obs	
	ASSET4 *z*-Score	Equally-weighted Score	Family	ASSET4 Gov	Traditional Gov	Old or Stale Board	Majority Election	Female Director	Year 2012	Full Sample
Australia	33.2	28.3	0.13	0.71	4.11	0.17	0.79	0.56	272	2,099
Austria	59.4	46.3	0.27	0.58	3.40	0.00	0.80	0.87	15	141
Belgium	57.2	44.3	0.38	0.61	3.13	0.21	0.71	0.83	24	242
Brazil	57.5	44.6	0.33	0.52	3.84	0.33	0.56	0.54	57	358
Canada	40.2	32.6	0.19	0.73	5.42	0.38	0.81	0.59	229	1,998
Chile	39.5	32.0	0.35	0.42	3.00	0.53	0.41	0.29	17	107
China	31.7	26.8	0.28	0.53	2.57	0.06	0.68	0.53	120	783
Colombia	40.4	34.2	0.20	0.50	3.90	0.17	0.60	0.50	10	56
Denmark	68.3	50.7	0.28	0.58	4.00	0.04	0.96	0.88	25	186
Egypt	18.3	18.1	0.36	0.36	2.18	0.00	0.09	0.55	11	59
Finland	80.9	62.1	0.17	0.62	5.38	0.00	0.29	1.00	24	264
France	81.9	63.3	0.49	0.54	2.11	0.21	0.70	0.99	89	861
Germany	70.5	56.0	0.28	0.58	2.03	0.13	0.81	0.93	72	541
Greece	59.0	47.0	0.50	0.49	2.56	0.20	0.38	0.81	16	152
Hong Kong	36.6	30.5	0.45	0.55	2.83	0.35	0.65	0.60	106	941
India	50.2	42.3	0.33	0.46	3.05	0.39	0.41	0.53	80	529
Indonesia	46.3	36.6	0.29	0.46	3.25	0.08	0.29	0.46	28	194
Ireland	49.2	41.6	0.13	0.70	4.67	0.20	0.73	0.87	15	147
Israel	42.1	33.7	0.53	0.56	4.00	0.47	0.60	1.00	15	98
Italy	60.8	49.9	0.26	0.59	3.00	0.36	0.72	0.72	43	422
Japan	67.1	54.3	0.04	0.36	2.21	0.24	0.38	0.12	349	2,129
Luxembourg	62.6	45.6	0.57	0.62	4.00	0.29	1.00	0.57	7	64
Malaysia	41.5	33.8	0.36	0.55	3.62	0.40	0.64	0.57	42	278
Mexico	45.4	35.8	0.77	0.44	3.81	0.63	0.38	0.46	26	190
Netherlands	67.9	52.2	0.18	0.70	3.91	0.06	0.85	0.73	33	334
New Zealand	44.2	34.2	0.10	0.69	4.70	0.11	1.00	0.80	10	129
Norway	68.1	52.0	0.18	0.63	4.53	0.00	0.53	1.00	17	151
Philippines	43.9	34.9	0.11	0.46	3.32	0.68	0.26	0.37	19	126
Poland	35.9	30.9	0.17	0.49	2.83	0.00	0.78	0.78	23	149
Portugal	73.4	57.5	0.58	0.60	2.58	0.17	0.67	0.67	12	120
Russia	46.8	36.3	0.53	0.48	4.31	0.17	0.31	0.53	32	239
Singapore	41.9	35.3	0.11	0.61	4.23	0.31	0.55	0.50	44	426
South Africa	50.2	39.4	0.12	0.65	4.16	0.09	0.92	0.92	119	580
South Korea	67.4	53.2	0.37	0.40	3.27	0.03	0.36	0.10	59	305
Spain	75.4	57.3	0.31	0.57	2.26	0.26	0.79	0.88	42	427
Sweden	75.6	57.5	0.40	0.60	4.73	0.08	0.30	1.00	40	417
Switzerland	57.7	45.3	0.33	0.60	3.91	0.21	0.86	0.57	58	508
Taiwan	54.4	43.2	0.05	0.43	2.75	0.15	0.32	0.48	75	418
Thailand	53.4	42.8	0.21	0.55	3.58	0.33	0.88	0.79	24	150
Turkey	57.9	44.7	0.54	0.45	3.25	0.10	0.38	0.54	24	151
UK	60.7	46.0	0.18	0.72	5.27	0.06	0.91	0.76	276	2,978
Overall	54.2	39.1	0.25	0.56	3.65	0.19	0.55	0.60	2,599	20,447

Table 2
Do Governance Mechanisms Affect Firms' Environmental Performance?

This table reports regression estimates of environmental scores on governance mechanisms and control variables. The dependent variables are the natural logarithm of environmental scores. The ASSET4 Environmental *z*-Score is a standardized score, calculated by and obtained from Thomson Reuters ASSET4 ESG, and measures firms' environmental performance relative to other companies in a given year. The Equally-weighted Environmental Score is the average of three category scores (Emission Reduction, Resource Reduction, and Product Innovation). The Material Environmental Score in Panel B measures each firm's environmental performance using only those line items from ASSET4 that are material according to the SASB Materiality Map. Appendix Table A2 describes the indicator variables used to calculate the environmental scores. All other variables are described in Appendix Table A1. The sample period is 2004-2015. All variables are winsorized at the 1st and 99th percentiles. All right-hand side variables are lagged by one year. Standard errors are clustered at the country-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: ASSET4 Environmental *z*-Scores

	ASSET4 Environmental *z*-Scores $_{t}$					
	(1)	(2)	(3)	(4)	(5)	(6)
Family $_{t-1}$	-0.100***	-0.106***	-0.095***	-0.112***	-0.114***	-0.104***
	(-3.15)	(-3.35)	(-3.00)	(-3.58)	(-3.81)	(-3.32)
ASSET4 Governance $_{t-1}$	0.818***					
	(5.69)					
Traditional Governance $_{t-1}$		0.031**				0.025**
		(2.56)				(2.05)
Old or Stale Board $_{t-1}$			-0.078***			
			(-3.46)			
Majority Election $_{t-1}$				0.092***		0.082***
				(4.05)		(3.53)
Female Director $_{t-1}$					0.147***	0.141***
					(4.61)	(4.53)
Log (Total Assets) $_{t-1}$	0.229***	0.228***	0.227***	0.225***	0.218***	0.215***
	(11.46)	(11.47)	(10.20)	(11.28)	(11.59)	(11.45)
Cash $_{t-1}$	-0.086	-0.081	-0.042	-0.092	-0.076	-0.080
	(-1.20)	(-1.13)	(-0.61)	(-1.30)	(-1.06)	(-1.10)
Tangibility $_{t-1}$	0.192***	0.194***	0.237***	0.197***	0.197***	0.198***
	(2.73)	(2.80)	(3.30)	(2.88)	(3.09)	(3.10)
Leverage $_{t-1}$	-0.161	-0.158	-0.227***	-0.160	-0.149	-0.152
	(-1.62)	(-1.58)	(-3.30)	(-1.62)	(-1.54)	(-1.55)
Profitability $_{t-1}$	0.326**	0.313**	0.271*	0.313**	0.287**	0.286**
	(2.27)	(2.19)	(1.90)	(2.21)	(2.08)	(2.05)
Other Blockholder $_{t-1}$	0.080*	0.067	0.058	0.062	0.062	0.067*
	(2.00)	(1.64)	(1.50)	(1.47)	(1.55)	(1.71)
Institutional Ownership $_{t-1}$	0.221*	0.245**	0.263**	0.259**	0.256**	0.224**
	(1.95)	(2.27)	(2.48)	(2.45)	(2.51)	(2.13)
Cross-list $_{t-1}$	-0.079**	-0.067*	-0.079**	-0.067*	-0.053	-0.068*
	(-2.04)	(-1.72)	(-2.10)	(-1.77)	(-1.42)	(-1.79)
Country×Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Obs	20,447	20,447	17,333	20,447	20,447	20,447
Adjusted R^2	0.454	0.449	0.465	0.450	0.453	0.457

Panel B: Equally-weighted Environmental Scores

	Equally-weighted Environmental Scores $_t$						Material E Score $_t$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Family $_{t-1}$	-0.076***	-0.082***	-0.076***	-0.086***	-0.088***	-0.080***	-0.138**
	(-2.98)	(-3.21)	(-2.91)	(-3.41)	(-3.62)	(-3.17)	(-2.15)
ASSET4 Governance $_{t-1}$	0.673***						
	(5.88)						
Traditional Governance $_{t-1}$		0.022**				0.018*	0.021
		(2.43)				(1.89)	(1.18)
Old or Stale Board $_{t-1}$			-0.048**				
			(-2.66)				
Majority Election $_{t-1}$				0.076***		0.069***	0.069**
				(4.21)		(3.66)	(2.07)
Female Director $_{t-1}$					0.113***	0.109***	0.107***
					(4.99)	(4.89)	(3.57)
Log (Total Assets) $_{t-1}$	0.197***	0.197***	0.196***	0.195***	0.189***	0.186***	0.255***
	(13.42)	(13.19)	(11.94)	(13.13)	(13.24)	(13.10)	(11.08)
Cash $_{t-1}$	-0.005	-0.001	0.046	-0.010	0.003	-0.001	-0.193
	(-0.07)	(-0.01)	(0.70)	(-0.14)	(0.04)	(-0.01)	(-1.20)
Tangibility $_{t-1}$	0.172***	0.174***	0.206***	0.176***	0.176***	0.177***	0.169*
	(3.31)	(3.41)	(4.02)	(3.49)	(3.74)	(3.73)	(1.76)
Leverage $_{t-1}$	-0.147*	-0.145*	-0.189***	-0.146*	-0.138*	-0.140*	-0.216**
	(-2.00)	(-1.96)	(-3.72)	(-2.00)	(-1.92)	(-1.93)	(-2.04)
Profitability $_{t-1}$	0.258**	0.248**	0.223*	0.248**	0.227*	0.227*	0.180
	(2.12)	(2.04)	(1.79)	(2.05)	(1.94)	(1.92)	(1.05)
Other Blockholder $_{t-1}$	0.039	0.027	0.023	0.024	0.024	0.028	0.038
	(1.26)	(0.86)	(0.78)	(0.73)	(0.76)	(0.89)	(0.64)
Institutional Ownership $_{t-1}$	0.122	0.145*	0.161**	0.154*	0.152**	0.128*	0.149
	(1.46)	(1.86)	(2.07)	(1.98)	(2.05)	(1.68)	(1.35)
Cross-list $_{t-1}$	-0.037	-0.026	-0.031	-0.027	-0.015	-0.027	-0.022
	(-1.35)	(-0.95)	(-1.11)	(-0.99)	(-0.59)	(-1.04)	(-0.38)
Country×Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	20,447	20,447	17,333	20,447	20,447	20,447	12,837
Adjusted R^2	0.530	0.524	0.541	0.526	0.529	0.532	0.516

Table 3
Governance Mechanisms and Firms' Environmental Performance: Firm Fixed Effects

This table reports firm fixed effects regression estimates of environmental scores on governance mechanisms and control variables. The dependent variables are the natural logarithm of the ASSET4 Environmental *z*-Score and our Equally-weighted Environmental as described in Table 2. All other variables are described in Appendix Table A1. We drop firms with time-invariant governance measures. Control variables (Family and all other firm controls) are included but not reported. The sample period is 2004-2015. All variables are winsorized at the 1st and 99th percentiles. All right-hand side variables are lagged by one year. Standard errors are clustered at the country-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: ASSET4 Environmental *z*-Scores

	ASSET4 Environmental *z*-Scores				
	(1)	(2)	(3)	(4)	(5)
ASSET4 Governance	0.161**				
	(2.43)				
Traditional Governance		0.014**			
		(2.31)			
Old or Stale Board			-0.024**		
			(-2.14)		
Majority Election				0.049***	
				(3.25)	
Female Director					0.029**
					(1.97)
Controls	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Obs	20,109	16,011	6,114	9,855	7,675
Adjusted R^2	0.856	0.857	0.864	0.825	0.833

Panel B: Equally-weighted Environmental Scores

	Equally-weighted Environmental Scores				
	(1)	(2)	(3)	(4)	(5)
ASSET4 Governance	0.085**				
	(2.31)				
Traditional Governance		0.010**			
		(2.33)			
Old or Stale Board			-0.017*		
			(-1.90)		
Majority Election				0.032***	
				(3.81)	
Female Director					0.018*
					(1.88)
Controls	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Obs	20,109	16,011	6,114	9,855	7,675
Adjusted R^2	0.907	0.906	0.911	0.887	0.891

Table 4
Governance Mechanisms and Firms' Environmental Performance: Evidence from Outside Shocks

This table reports regression estimates of environmental scores for years surrounding quotas for female board representation and a quasi-exogenous shock to majority director election rules. The dependent variables are the natural logarithm of the ASSET4 Environmental *z*-Score and our Equally-weighted Environmental as described in Table 2. All other variables are described in Appendix Table A1. Panel A shows results for female board quotas in France and quasi-exogenous shocks to majority director elections in Canada. Models 1 and 2 focus on the France and the 2011 quota that mandated 20% female board representation by 2014. Treated firms add women to the board in 2011 or 2012; control firms already had women on the board of directors. Models 3 and 4 focus on Canada and the initiative of the CCGG to increase majority voting adoption (Doidge et al., 2019) leading to significant changes in firm adoptions in 2006 and 2007. Treated firms adopt majority voting in 2006 or 2007; control firms do not change majority voting policies during the 2004 to 2008 period. Panel B shows results for countries with female board quotas or for which there was significant outside pressure for greater female board representation. Models 1 and 2 include all countries with legislated quotas for female board representation that happen at least two years after our sample begins and two years before our sample ends. Models 3 and 4 supplement countries with mandated quotas with Germany and the UK who both faced substantial outside pressure for more female board representation in 2011. Further details for these quotas and outside pressure are in Appendix Table A6. All specifications include two years before and after the event years. Firms that change family control, other-blockholder control, or cross-listing status are excluded. All variables are winsorized at the 1st and 99th percentiles. All right-hand side variables are lagged by one year. Standard errors are robust in Panel A and are clustered at the country-level in Panel B. *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Single Country Experiences

	Exogenous Shock: Female Board Quota Introduction in France		Quasi-exogenous Shock: Majority Director Elections in Canada	
	ASSET4 E *z*-Scores	Equally-weighted E Scores	ASSET4 E *z*-Scores	Equally-weighted E Scores
	(1)	(2)	(3)	(4)
Post × Treated	0.113**	0.154***	0.212**	0.403***
	(2.00)	(3.62)	(2.57)	(6.16)
Log (Total Assets)	0.286**	0.240***	0.057	0.389***
	(2.49)	(2.77)	(0.71)	(5.23)
Cash	-0.178	-0.248	0.299	0.919*
	(-0.52)	(-0.83)	(0.48)	(1.89)
Tangibility	0.506	0.173	1.094*	1.060**
	(0.89)	(0.40)	(1.78)	(2.06)
Leverage	-0.674**	-0.633***	-0.579	-0.335
	(-2.43)	(-2.61)	(-1.52)	(-1.18)
Profitability	-0.829**	-0.309	-0.303	0.342
	(-2.02)	(-1.20)	(-0.64)	(0.88)
Institutional Ownership	0.368*	0.153	0.109	0.410*
	(1.91)	(1.10)	(0.35)	(1.69)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Obs	384	384	237	237
Adjusted R^2	0.754	0.842	0.811	0.804

Panel B: Female Board Quotas for Broad Country Samples

	Countries with Mandatory Female Board Quotas Through Legislation		Countries with Mandatory Female Board Quotas Through Legislation or Outside Push to Increase Female Board Representation	
	ASSET4 E *z*-Scores	Equally-weighted E Scores	ASSET4 E *z*-Scores	Equally-weighted E Scores
	(1)	(2)	(3)	(4)
Post × Treated	0.092**	0.061**	0.094***	0.061***
	(3.24)	(2.85)	(4.70)	(4.00)
Log (Total Assets)	0.024	0.012	0.017	0.012
	(0.63)	(0.41)	(0.71)	(0.69)
Cash	-0.187	-0.077	-0.151**	-0.062
	(-1.36)	(-0.90)	(-2.32)	(-1.43)
Tangibility	-0.040	0.037	-0.001	0.058
	(-0.73)	(1.36)	(-0.02)	(1.41)
Leverage	-0.119	-0.110	-0.051	-0.070
	(-0.61)	(-0.82)	(-0.42)	(-0.86)
Profitability	-0.074	-0.037	-0.056	-0.030
	(-0.51)	(-0.45)	(-0.57)	(-0.53)
Institutional Ownership	-0.041	0.156	0.064	0.107*
	(-0.23)	(1.37)	(0.63)	(1.90)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Obs	1,602	1,602	2,856	2,856
Adjusted R^2	0.909	0.945	0.905	0.946

Table 5
The Effect of Governance in Countries with Weak Environmental Performance

This table reports regression estimates of environmental scores on governance mechanisms and control variables for firms grouped by their countries' environmental social norms. The dependent variables are the natural logarithm of the ASSET4 Environmental *z*-Score and our Equally-weighted Environmental Score as described in Table 2. We sort firms into low and high country-level environmental performance groups. In models 1 and 2, we split the sample based on country-level average Environmental ASSET4 z-Scores (and Equally-weighed Environmental Scores) using the sample median as a cutoff. In models 3 and 4, we employ below- or above-median cutoffs on a country's Environmental Performance Index score as used in Dyck et. al. (2019). The Environmental Performance Index (EPI) is obtained from the Yale Center for Environmental Law, Yale University, and the Center for International Earth Science Information Network, Columbia University. In models 5 and 6, we compare countries outside of Continental Europe with Continental European counties where environmental social norms are high. All other variables are described in Appendix Table A1. Control variables are included but not reported. The sample period is 2004-2015. All variables are winsorized at the 1st and 99th percentiles. All right-hand side variables are lagged by one year. Standard errors are clustered at the country-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: ASSET4 Environmental *z*-Scores

	ASSET4 Environmental *z*-Scores					
	Low Country-level ASSET4 E *z*-Scores	High Country-level ASSET4 E *z*-Scores	Low Environmental Protection Index	High Environmental Protection Index	Outside Continental Europe Countries	Continental Europe Countries
	(1)	(2)	(3)	(4)	(5)	(6)
Family	-0.150***	-0.065*	-0.118***	-0.104*	-0.132***	-0.061
	(-2.85)	(-1.75)	(-3.06)	(-1.99)	(-4.03)	(-1.35)
Traditional Governance	0.030*	0.013	0.026*	0.032	0.026*	0.014
	(2.08)	(0.83)	(1.78)	(1.57)	(1.73)	(0.74)
Majority Election	0.086*	0.076***	0.091***	0.054	0.094***	0.039
	(2.02)	(2.99)	(3.13)	(1.81)	(3.55)	(1.01)
Female Director	0.129***	0.149***	0.157***	0.116	0.155***	0.056
	(2.97)	(5.05)	(4.67)	(1.66)	(4.54)	(0.95)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	9,172	11,141	13,967	6,348	15,285	5,023
Adjusted R^2	0.403	0.381	0.452	0.408	0.448	0.404

Panel B: Equally-weighted Environmental Scores

	Equally-weighted Environmental Scores					
	Low Country-level Equally-weighted E Scores	High Country-level Equally-weighted E Scores	Low Environmental Protection Index	High Environmental Protection Index	Non-continental Europe Countries	Continental Europe Countries
	(1)	(2)	(3)	(4)	(5)	(6)
Family	-0.110**	-0.051*	-0.087**	-0.076*	-0.097***	-0.051
	(-2.53)	(-1.77)	(-2.75)	(-1.94)	(-3.63)	(-1.30)
Traditional Governance	0.023**	0.008	0.020*	0.021	0.021*	0.005
	(2.15)	(0.67)	(1.72)	(1.32)	(1.81)	(0.41)
Majority Election	0.062*	0.070***	0.074***	0.055*	0.073***	0.048
	(1.84)	(3.41)	(3.27)	(2.00)	(3.31)	(1.57)
Female Director	0.098***	0.117***	0.117***	0.092*	0.117***	0.055
	(3.03)	(5.91)	(4.80)	(1.89)	(4.79)	(1.28)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs	9,172	11,141	13,967	6,348	15,285	5,023
Adjusted R^2	0.447	0.496	0.512	0.558	0.522	0.522

Table 6
The Effect of Governance on Family-controlled Firms' Environmental Performance

This table shows overall effects of governance mechanisms on firms' environmental performance for firms with different blockholders (family-controlled vs. widely held/other). Each regression model includes an indicator variable for whether a firm is controlled by a family, the governance mechanisms in question, an interaction term between the family indicator and the governance mechanisms, and controls. The reported coefficient estimate on Family is the sum of the coefficient estimates on the governance measure and the interaction between the family indicator variable and the governance measure. The reported coefficient on Widely Held/Other is the coefficient estimate on the standalone governance variable. The dependent variables are the natural logarithm of the ASSET4 Environmental *z*-Score and our Equally-weighted Environmental as described in Table 2. All other variables are described in Appendix Table A1. Control variables are included but not reported. The sample period is 2004-2015. All variables are winsorized at the 1st and 99th percentiles. All right-hand side variables are lagged by one year. Standard errors are clustered at the country-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	ASSET4 Environmental *z*-Scores	Equally-weighted Environmental Scores
	(1)	(2)
Family		
Traditional Governance	0.005	0.003
	(0.28)	(0.21)
Majority Election	0.037	0.025
	(0.78)	(0.70)
Female Director	0.124***	0.103***
	(2.96)	(3.04)
Widely Held/Other		
Traditional Governance	0.030**	0.022*
	(2.09)	(1.97)
Majority Election	0.096***	0.082***
	(3.79)	(3.86)
Female Director	0.146***	0.110***
	(4.30)	(4.62)
Controls	Yes	Yes
Country×Year Fixed Effects	Yes	Yes
Industry×Year Fixed Effects	Yes	Yes
Obs	20,447	20,447
Adjusted R^2	0.457	0.532

Table 7
Alternative Environmental Performance Measures

This table reports regression estimates of alternative environmental performance measures on governance mechanisms and control variables. The dependent variables are the natural logarithm of environmental scores. The ASSET4 Environmental Category *z*-Scores are standardized scores, calculated by and obtained from Thomson Reuters ASSET4 ESG, and measure firms' environmental performance relative to other companies in a given year for the categories Emission Reduction, Resource Reduction, and Product Innovation. The Equally-weighted Environmental Category Scores for the categories Emission Reduction, Resource Reduction, and Product Innovation are calculated as the sum of all indicator variables in each category divided by the number of reported items times 100. Appendix Table A2 describes the indicator variables used to calculate the environmental scores. All other variables are described in Appendix Table A1. Control variables are included but not reported. The sample period is 2004-2015. All variables are winsorized at the 1st and 99th percentiles. All right-hand side variables are lagged by one year. Standard errors are clustered at the country-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Environmental Category Scores					
	ASSET4			Equally-weighted		
Categories	Emission Reduction	Resource Reduction	Product Innovation	Emission Reduction	Resource Reduction	Product Innovation
	(1)	(3)	(2)	(4)	(6)	(5)
Family	-0.102***	-0.105***	-0.084**	-0.020***	-0.018**	-0.024***
	(-3.62)	(-3.23)	(-2.63)	(-3.33)	(-2.50)	(-3.30)
Traditional Governance	0.025**	0.029**	0.009	0.002	0.001	0.005*
	(2.22)	(2.36)	(0.79)	(1.06)	(0.28)	(1.93)
Majority Election	0.079***	0.076***	0.067***	0.019***	0.023***	0.023***
	(3.18)	(3.04)	(3.52)	(4.14)	(5.40)	(4.44)
Female Director	0.119***	0.151***	0.071***	0.023***	0.015***	0.030***
	(4.11)	(4.06)	(4.03)	(5.17)	(3.47)	(4.25)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country×Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Obs	20,447	20,447	20,447	20,447	20,447	20,447
Adjusted R^2	0.428	0.375	0.416	0.537	0.495	0.476

Table 8
Governance Mechanisms and Firms' Environmental Performance in Dirty and Clean Industries

This table shows summary statistics (Panel A) and regression estimates (Panels B) of environmental scores on governance measures and control variables for firms grouped by industries with low and high environmental performance. Industries are classified as 'dirty' and 'clean' based on average industry-level ASSET4 Environmental *z*-Scores and the SASB materiality map. The first classification is based on industry-level ASSET4 Environmental *z*-Scores; SIC Divisions ABFGI are classified as 'dirty' sectors because they are below or equal to the median of 46.7 and SIC Divisions CDEFH are 'clean' sectors. The second classification is based on the SASB materiality map. We map the 11 sub-categories from the SASB sections pertaining to environmental performance (Environment and Business Model and Innovation) and construct our own score 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 ABI. SIC Divisions CDEFH are considered as 'clean' industries. The dependent variables are the natural logarithm of the ASSET4 Environmental *z*-Score and our Equally-weighted Environmental as described in Table 2. All other variables are described in Appendix Table A1. Control variables are included but not reported. The sample period is 2004-2015. All variables are winsorized at the 1st and 99th percentiles. All right-hand side variables are lagged by one year. Standard errors are clustered at the country-level and t-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Summary Statistics

SIC Division	Industry Name / Classification	Averages								Obs	
		ASSET4 E *z*-Score	Equally-weighted E Score	Family	ASSET4 Gov	Traditional Gov	Old or Stale Board	Majority Election	Female Director	Year 2012	Full Sample
A	Agriculture, Forestry, Fishing	39.9	30.8	0.46	0.58	3.61	0.28	0.68	0.34	18	112
B	Mining	38.2	28.4	0.14	0.65	4.39	0.21	0.67	0.41	330	2,383
C	Construction	53.8	37.4	0.28	0.52	3.10	0.22	0.44	0.55	115	926
D	Manufacturing	66.8	47.9	0.26	0.53	3.49	0.20	0.50	0.56	872	6,796
E	Transport., Comm., Utilities	56.8	39.9	0.21	0.54	3.48	0.17	0.56	0.66	383	3,053
F	Wholesale Trade	46.6	33.0	0.20	0.56	3.68	0.13	0.51	0.64	69	500
G	Retail Trade	47.8	34.4	0.38	0.57	3.77	0.22	0.56	0.70	151	1,244
H	Finance, Insurance, Real Estate	49.4	37.3	0.15	0.55	3.53	0.18	0.55	0.70	425	3,437
I	Services	41.1	29.4	0.25	0.61	3.94	0.20	0.59	0.62	236	1,996
ABFGI	'Dirty' Industries, ASSET4	41.7	30.3	0.23	0.61	4.05	0.21	0.61	0.55	804	6,235
CDEH	'Clean' Industries, ASSET4	59.6	43.0	0.22	0.54	3.47	0.19	0.52	0.62	1,795	14,212
ABI	'Dirty' Industries, SASB	39.5	28.9	0.20	0.63	4.17	0.21	0.64	0.50	584	4,491
CDEFH	'Clean' Industries, SASB	58.3	42.0	0.23	0.54	3.50	0.19	0.52	0.62	2,015	15,956

Panel B: Regressions Based on 'Dirty' and 'Clean' Industries

'Dirty'/'Clean' Industry Classification	ASSET4 Environmental *z*-Scores		Equally-weighted Environmental Scores		ASSET4 Environmental *z*-Scores		Equally-weighted Environmental Scores	
	Industry-level ASSET4 Environmental *z*-Scores				SASB Materiality Map			
SIC Divisions	'Dirty' ABFGI	'Clean' CDEH	'Dirty' ABFGI	'Clean' CDEH	'Dirty' ABI	'Clean' CDEFGH	'Dirty' ABI	'Clean' CDEFGH
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Family	-0.086**	-0.110**	-0.067**	-0.081**	-0.071	-0.110***	-0.051	-0.081**
	(-2.15)	(-2.66)	(-2.34)	(-2.36)	(-1.40)	(-2.81)	(-1.44)	(-2.55)
Traditional Governance	0.026	0.020	0.019	0.015	0.026	0.022*	0.023	0.015
	(1.32)	(1.68)	(1.48)	(1.54)	(1.15)	(1.72)	(1.43)	(1.57)
Majority Election	0.086*	0.092***	0.063*	0.079***	0.076	0.091***	0.055	0.077***
	(1.98)	(3.62)	(1.80)	(3.95)	(1.38)	(3.42)	(1.26)	(3.69)
Female Director	0.144***	0.131***	0.099***	0.107***	0.148***	0.129***	0.098***	0.106***
	(4.14)	(3.63)	(4.07)	(3.79)	(4.83)	(3.63)	(4.91)	(3.89)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country×Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	6,172	14,209	6,172	14,209	4,411	15,954	4,411	15,954
Adjusted R^2	0.493	0.414	0.556	0.491	0.521	0.419	0.571	0.498

Table 9
Director Characteristics, Board Renewal, and Improved Environmental Performance

This table reports regression estimates of environmental scores on board characteristics, governance mechanisms, and control variables. The dependent variables are the natural logarithm of the ASSET4 Environmental *z*-Score and our Equally-weighted Environmental as described in Table 2. The board characteristics (CEO Experience, Higher Education, MBA, Age, Tenure, and Same Name) are the average across all board members in a given firm-year. The below (above) median female characteristics are indicator variables equal to one if there is a new female board member in a given year whose characteristics are equal to or less (greater) than the average of all board members in that year, and zero otherwise. All other variables are described in Appendix Table A1. Control variables are included but not reported. The sample period is 2004-2015. All variables are winsorized at the 1st and 99th percentiles. All right-hand side variables are lagged by one year. Standard errors are clustered at the country-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Female Characteristics Grouping Variable	ASSET4 Environmental *z*-Scores					Equally-weighted Environmental Scores				
				CEO Experience	Higher Education				CEO Experience	Higher Education
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Majority Election	0.075**		0.074**	0.073***	0.074***	0.064***		0.063***	0.062***	0.062***
	(2.66)		(2.54)	(2.91)	(2.96)	(2.98)		(2.85)	(3.13)	(3.17)
Female Director	0.146***		0.152***			0.115***		0.120***		
	(5.05)		(5.15)			(6.03)		(6.16)		
CEO Experience		0.207***	0.208***				0.171***	0.175***		
		(2.92)	(3.30)				(3.47)	(4.02)		
Higher Education		0.135*	0.094				0.111	0.079		
		(1.85)	(1.27)				(1.68)	(1.18)		
MBA		-0.031	-0.061				-0.029	-0.051		
		(-0.24)	(-0.48)				(-0.28)	(-0.51)		
Age		0.005	0.005				0.004	0.004		
		(1.27)	(1.31)				(1.31)	(1.39)		
Tenure		-0.004	-0.000				-0.003	0.001		
		(-1.10)	(-0.02)				(-0.80)	(0.20)		
Same Name		-0.126	-0.064				-0.117	-0.069		
		(-1.03)	(-0.50)				(-1.31)	(-0.72)		
Female Characteristics										
Below Median Group				0.130***	0.137***				0.102***	0.108***
				(5.00)	(4.86)				(6.16)	(5.56)
Above Median Group				0.091***	0.075***				0.077***	0.062***
				(4.62)	(4.03)				(5.09)	(4.41)
Family	-0.100***		-0.099***	-0.094***	-0.093***	-0.080***		-0.079***	-0.074***	-0.073***
	(-2.95)		(-3.19)	(-2.93)	(-2.84)	(-2.90)		(-3.15)	(-2.79)	(-2.71)
Traditional Governance	0.033**		0.025**	0.032**	0.033**	0.022**		0.016*	0.023**	0.023**
	(2.70)		(2.19)	(2.61)	(2.63)	(2.41)		(1.75)	(2.42)	(2.45)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	15,874	15,874	15,874	17,333	17,333	15,874	15,874	15,874	17,333	17,333
Adjusted R^2	0.459	0.450	0.462	0.475	0.475	0.541	0.532	0.544	0.551	0.551

Appendix

Table A1
Variable Descriptions and Data Sources

Variable	Description	Source
A. Environmental Performance Measures		
ASSET4 Environmental *z*-Score	Proprietary-weighted aggregate scores of environmental performance that ASSET4 provides to investors. These rank-based scores range from 0 to 100 and measure the environmental performance relative to all companies in a given year.	ASSET4 (from Thomson Reuters)
Equally-weighted Environmental Score	Aggregate score based of 70 line items of environmental commitments across three categories (emission reduction, resource reduction, and product innovation). Each line item is translated into an indicator variable such that a 'one' corresponds to better environmental performance (e.g., a below-median greenhouse gas emission firm would get a 'one'). Category scores are calculated as the sum of all indicator variables in each category divided by the number of reported items times 100. The Equally-weighted Environmental Score is the average of the category scores. Appendix Table A2 describes the indicator variables used to calculate the environmental scores.	ASSET4
Material Environmental Score	Follows the approach of the Equally-weighted Environmental Score. The score is based only on those line items from ASSET4 that are 'material' according to the SASB Materiality Map.	ASSET4, SASB
ASSET4 E Category *z*-Scores	Category scores for emission reduction, resource reduction, and product innovation. These scores are proprietary-weighted aggregate category scores that ASSET4 provides to investors. These rank-based scores range from 0 to 100 and measure the environmental performance relative to all other companies in a given year.	ASSET4
Equally-weighted E Category Scores	Category scores for emission reduction, resource reduction, and product innovation. The scores are based on line items of environmental commitments across the three environmental categories. Each line item is translated into an indicator variable such that a 'one' corresponds to better environmental performance (e.g., a below-median greenhouse gas emission firm would get a 'one'). The category scores are calculated as the sum of all indicator variables in each category divided by the number of reported items times 100. Appendix Table A2 describes the indicator variables used to calculate the environmental scores.	ASSET4
B. Governance Mechanisms		
Family	Indicator variable that equals one if the firm is controlled by a family, zero otherwise. For each firm-year, we classify a firm as controlled by a family if any of the following conditions are met: 1) Orbis (Bureau van Dijk) identifies a family as the ultimate owner of the firm with a minimum controlling threshold of 25% (following Lins, Volpin, and Wagner, 2013); 2) Orbis identifies the ultimate owner to be a Nominee, Trust, or Trustee, and the firm has dual class shares (obtained from ASSET4); 3) Datastream reports a minimum family stake of 20%, or Datastream reports a minimum family stake of 5% and the firm has dual class shares; 4) the Global Family Business Index (obtained from Center for Family Business at the University of St. Gallen, Switzerland) reports the firm as family controlled. For each firm, we impute intermittent years as family controlled if a firm is classified as family controlled in at least one earlier and one later year. We further extend family control both backwards and forwards in time if ASSET4 indicates that the votes of a firm's largest blockholder are within 5% of the year during which a firm is known to be family controlled and the largest blockholder's stake is at least 20%.	ASSET4, Datastream, Orbis, Global Family Business Index
Widely Held	Indicator variable that equals one if the firm is not controlled by a blockholder, zero otherwise. For each firm-year, we classify a firm as widely held if any of the following conditions are met: 1) Orbis classifies the firm as known to be widely held and the firm is not classified as family controlled by the previous rules; 2) ASSET4 indicates the largest blockholder's stake is below 50%, or does not report any largest blockholder stake; 3) the firm is not classified as family controlled.	ASSET4, Datastream, Orbis

Other Blockholder	Indicator variable that equals one if the firm is not family controlled or widely held, zero otherwise. This category includes controlling blockholders that are non-financial firms (themselves widely held), financial investors, governments, banks, and insurance firms.	ASSET4, Datastream, Orbis
ASSET4 Governance	Aggregate score based of 38 line items of governance commitments across four categories (board function, board structure, compensation policy, shareholder rights). Each line item is translated into an indicator variable such that a 'one' corresponds to a better governance mechanism. Category scores are calculated as the sum of all indicator variables in each category divided by the number of reported items. The ASSET4 Governance is the average of the category scores. Appendix Table A4 describes the indicator variables used to calculate the governance scores.	ASSET4
Board Independence	Indicator variable that equals one if the board has more than 50% independent directors, zero otherwise.	ASSET4, BoardEx
Board Size	Indicator variable that equals one if the board has more than five but less than 16 members, zero otherwise.	ASSET4, BoardEx
CEO-Chairman Separation	Indicator variable that equals one if the CEO is not the chairman of the board of directors, zero otherwise.	ASSET4, BoardEx
Board Structure	Indicator variable that equals one if all board members are individually elected (no staggered board), zero otherwise.	ASSET4
Audit Committee Indep.	Indicator variable that quals one if the audit committee is composed only of independent directors, zero otherwise.	ASSET4
Stock Classes	Indicator variable that equals one if all shares of the company provide equal voting rights, zero otherwise.	ASSET4
Traditional Governance	Sum of the six indicator variables Board Independence, Board Size, CEO-Chairman Separation, Board Structure, Audit Committee Independence, Stock Class.	BoardEx, ASSET4
Old or Stale Board	Indicator variable that equals one if at least 20% of the directors is over 70 years old or if at least 50% of directors have a tenure greater than nine years, zero otherwise.	BoardEx
Majority Election	Indicator variable that equals one if the board members are generally elected with a majority vote, zero otherwise.	ASSET4
Female Director	Indicator variable that equals one if the firm has at least one female director, zero otherwise.	ASSET4, BoardEx
One Female Director	Indicator variable that equals one if the firm has one female director on the board, zero otherwise.	ASSET4, BoardEx
Two+ Female Directors	Indicator variable that equals one if the firm has two or more female directors on the board, zero otherwise.	ASSET4, BoardEx
Percent Female Directors	Number of female directors divided by the number of directors on the board.	ASSET4, BoardEx
C. Firm Characteristics		
Log(Total Assets)	Natural logarithm of total assets in US$ million.	Worldscope
Cash	Cash and cash equivalents divided by total assets.	Worldscope
Tangibility	Property, plant, and equipment divided by total assets.	Worldscope
Leverage	Total debt divided by total assets.	Worldscope
Profitability	Net income plus after-tax interest expenses divide by total assets.	Worldscope
Institutional Ownership	Total institutional ownership.	Factset
Cross-list	Indicator variable that equals one if the firm is cross-listed on a major US exchange, zero otherwise.	ADR lists, CRSP
D. Board Characteristics		
CEO Experience	Fraction of board members who have prior CEO experience.	BoardEx
MBA	Fraction of board members who hold an MBA.	BoardEx
Higher Education	Fraction of board members with non-MBA graduate degrees.	BoardEx
Same Name	Fraction of board members that have the same last name.	BoardEx
Age	Average age in years of all board members.	BoardEx
Tenure	Average board tenure in years of all board members.	BoardEx

Table A2
Thomson Reuters ASSET4 ESG Environmental Data

We create environmental indicator variables based on the Thomson Reuters ASSET4 ESG environmental indicator values (line items). Indicator values are the answers to Y/N questions, double Y/N questions, and numerical questions. We translate the answers to these questions into indicator variables. More specifically, for questions with a positive direction (i.e., a 'yes' answer or a greater number is associated with better environmental performance), we translate the answers to Y/N questions into 0 (N) and 1 (Y); the answers to double Y/N questions into 0 (NN), 0.5 (YN or NY), and 1 (YY); and the answers to numerical questions into 0 (value is less (or equal) than zero; or value is less (or equal) than the median; see also column 'Translation Numeric Values') and 1 (value is greater than zero; or value is greater than the median; see also column 'Translation Numeric Values'). For questions with a negative direction (i.e., a 'no' answer or a lower number is associated with better social performance), the opposite coding applies. The data are from the ASSET4 ESG database.

Items		Description	Direction	Question Type	Translation Numeric Values
A.	Emission Reduction				
1)	Biodiversity Controversies	Is the company under the spotlight of the media because of a controversy linked to biodiversity?	Negative	Y/N	
2)	Biodiversity Impact	Does the company report on initiatives to protect, restore or reduce its impact on native ecosystems and species, biodiversity, protected and sensitive areas?	Positive	Y/N	
3)	Cement CO2 Emissions	Total CO2 and CO2 equivalents emission in kilograms per tonne of cement produced.	Negative	Number	Median
4)	Climate Change Risks and Opportunities	Is the company aware that climate change can represent commercial risks and/or opportunities?	Positive	Y/N	
5)	CO2 Reduction	Does the company show an initiative to reduce, reuse, recycle, substitute, phased out or compensate CO2 equivalents in the production process?	Positive	Y/N	
6)	Discharge into Water System	Total weight of water pollutant emissions in tonnes divided by net sales or revenue in U.S. dollars.	Negative	Number	Median
7)	Environmental Compliance	All real or estimated penalties, fines from lost court cases, settlements or cases not yet settled regarding environmental controversies in U.S. dollars.	Negative	Number	Zero
8)	Environmental Expenditures	Does the company report on its environmental expenditures or does the company report to make proactive environmental investments to reduce future risks or increase future opportunities?	Positive	Y/N	
9)	Environmental Management Systems	The percentage of company sites or subsidiaries that are certified with any environmental management system.	Positive	Number	Median
10)	Environmental Partnerships	Does the company report on partnerships or initiatives with specialized NGOs, industry organizations, governmental or supragovernmental organizations that focus on improving environmental issues?	Positive	Y/N	
11)	Environmental Restoration Initiatives	Does the company report or provide information on company-generated initiatives to restore the environment?	Positive	Y/N	
12)	F-Gases Emissions	Does the company report on initiatives to recycle, reduce, reuse or phase out fluorinated gases such as HFCs (hydrofluorocarbons), PFCs (perfluorocarbons) or SF6 (sulphur hexafluoride)?	Positive	Y/N	
13)	Greenhouse Gas Emissions	Total CO2 and CO2 equivalents emission in tonnes divided by net sales or revenue in U.S. dollars.	Negative	Number	Median
14)	Hazardous Waste	Total amount of hazardous waste produced in tonnes divided by net sales or revenue in U.S. dollars.	Negative	Number	Median
15)	Implementation	Does the company describe the implementation of its emission reduction policy through a public commitment from a senior management or board member? AND Does the company describe the implementation of its emission reduction policy through the processes in place?	Positive	Double Y/N	
16)	Improvements	Does the company set specific objectives to be achieved on emission reduction?	Positive	Y/N	
17)	Innovative Production	Does the company report on the concentration of production locations in order to limit the environmental impact during the production process? OR Does the company report on its participation in any emissions trading initiative? OR Does the company report on new production techniques to improve the global environmental impact (all emissions) during the production process?	Positive	Y/N	
18)	Monitoring	Does the company monitor its emission reduction performance?	Positive	Y/N	
19)	NOx and SOx Emissions Reduction	Does the company report on initiatives to reduce, reuse, recycle, substitute, or phase out SOx (sulphur oxides) or NOx (nitrogen oxides) emissions?	Positive	Y/N	
20)	Ozone-Depleting Substances Reduction	Does the company report on initiatives to reduce, substitute, or phase out ozone-depleting (CFC-11 equivalents, chlorofluorocarbon) substances?	Positive	Y/N	
21)	Policy	Does the company have a policy for reducing environmental emissions or its impacts on biodiversity? AND Does the company have a policy for maintaining an environmental management system?	Positive	Double Y/N	
22)	Spill Impact Reduction	Does the company report on initiatives to reduce, avoid or minimize the effects of spills or other polluting events (crisis management system)?	Positive	Y/N	
23)	Spills and Pollution Controversies	Is the company directly or indirectly (through a supplier) under the spotlight of the media because of a controversy linked to the spill of chemicals, oils and fuels, gases (flaring) or controversy relating to the overall impacts of the company on the environment?	Negative	Y/N	
24)	Transportation Impact Reduction	Does the company report on initiatives to reduce the environmental impact of transportation of its products or its staff?	Positive	Y/N	
25)	VOC Emissions Reduction	Does the company report on initiatives to reduce, substitute, or phase out volatile organic compounds (VOC) or particulate matter less than ten microns in diameter (PM10)?	Positive	Y/N	
26)	Waste	Total amount of waste produced in tonnes divided by net sales or revenue in U.S. dollars.	Negative	Number	Median
27)	Waste Recycling Ratio	Total recycled and reused waste produced in tonnes divided by total waste produced in tonnes.	Positive	Number	Median
28)	Waste Reduction	Does the company report on initiatives to recycle, reduce, reuse, substitute, treat or phase out total waste, hazardous waste or wastewater?	Positive	Y/N	
B.	Resource Reduction				
1)	Cement Energy Use	Total energy use in gigajoules per tonne of clinker produced.	Negative	Number	Median
2)	Energy Efficiency Initiatives	Does the company report on initiatives to use renewable energy sources? AND Does the company report on initiatives to increase its energy efficiency overall?	Positive	Double Y/N	
3)	Energy Use	Total direct and indirect energy consumption in gigajoules divided by net sales or revenue in U.S. dollars.	Negative	Number	Median

4)	Environmental Resource Impact Controversies	Is the company under the spotlight of the media because of a controversy linked to the environmental impact of its operations on natural resources or local communities?	Negative	Y/N	
5)	Environmental Supply Chain Management	Does the company use environmental criteria (ISO 14000, energy consumption, etc.) in the selection process of its suppliers or sourcing partners? AND Does the company report or show to be ready to end a partnership with a sourcing partner, if environmental criteria are not met?	Positive	Double Y/N	
6)	Green Buildings	Does the company have environmentally friendly or green sites or offices?	Positive	Y/N	
7)	Implementation	Does the company describe the implementation of its resource efficiency policy through a public commitment from a senior management or board member? AND Does the company describe the implementation of its resource efficiency policy through the processes in place?	Positive	Double Y/N	
8)	Improvements	Does the company set specific objectives to be achieved on resource efficiency? AND Does the company comment on the results of previously set objectives?	Positive	Double Y/N	
9)	Land Use	Does the company report on initiatives to reduce the environmental impact on land owned, leased or managed for production activities or extractive use?	Positive	Y/N	
10)	Materials	Total amount of materials used in tons divided by net sales or revenue in U.S. dollars.	Negative	Number	Median
11)	Materials Recycled and Reused Ratio	The percentage of recycled materials of the total materials used.	Positive	Number	Median
12)	Monitoring	Does the company monitor its resource efficiency performance?	Positive	Y/N	
13)	Policy	Does the company have a policy for reducing the use of natural resources? AND Does the company have a policy to lessen the environmental impact of its supply chain?	Positive	Double Y/N	
14)	Renewable Energy Use	Total energy generated from primary renewable energy sources divided by total energy.	Positive	Number	Median
15)	Toxic Chemicals	Does the company report on initiatives to reduce, reuse, substitute or phase out toxic chemicals or substances?	Positive	Y/N	
16)	Water Recycling	Does the company report on initiatives to reuse or recycle water? OR Does the company report on initiatives to reduce the amount of water used?	Positive	Y/N	
17)	Water Use	Total water withdrawal in cubic meters divided by net sales or revenue in U.S. dollars.	Negative	Number	Median

C. Product Innovation

1)	Animal Testing	Is the company endorsing guidelines on animal testing (e.g., the EU guideline on animal experiments)? OR Has the company established a programme or an initiative to reduce, phase out or substitute for animal testing?	Positive	Y/N	
2)	Eco-Design Products	Does the company report on specific products which are designed for reuse, recycling or the reduction of environmental impacts?	Positive	Y/N	
3)	Energy Footprint Reduction	Does the company describe initiatives in place to reduce the energy footprint of its products during their use?	Positive	Y/N	
4)	Environmental Asset Management	Does the company report on assets under management which employ environmental screening criteria or environmental factors in the investment selection process?	Positive	Y/N	
5)	Environmental Labels and Awards	Has the company received product awards with respect to environmental responsibility? OR Does the company use product labels (e.g., FSC, Energy Star, MSC) indicating the environmental responsibility of its products?	Positive	Y/N	
6)	Environmental Products	Does the company report on at least one product line or service that is designed to have positive effects on the environment or which is environmentally labelled and marketed?	Positive	Y/N	
7)	Environmental Project Financing	Is the company a signatory of the Equator Principles (commitment to manage environmental issues in project financing)? OR Does the company claim to evaluate projects on the basis of environmental or biodiversity risks as well?	Positive	Y/N	
8)	Environmental R&D	Does the company invest in R&D on new environmentally friendly products or services that will limit the amount of emissions and resources needed during product use?	Positive	Y/N	
9)	Environmental R&D Expenditures	Total amount of environmental R&D costs (without clean up and remediation costs) divided by net sales or revenue in U.S. dollars.	Positive	Number	Median
10)	GMO Free Products	Does the company make a commitment to exclude GMO ingredients from its products or retail offerings?	Positive	Y/N	
11)	Hybrid Vehicles	Is the company developing hybrid vehicles?	Positive	Y/N	
12)	Implementation	Does the company describe the implementation of its environmental product innovation policy?	Positive	Y/N	
13)	Improvements	Does the company set specific objectives to be achieved on environmental product innovation?	Positive	Y/N	
14)	Labelled Wood Percentage	The percentage of labelled wood or forest products (e.g., Forest Stewardship Council (FSC)) from total wood or forest products.	Positive	Number	Median
15)	Liquefied Natural Gas	Does the company develop new products and services linked to liquefied natural gas?	Positive	Y/N	
16)	Monitoring	Does the company describe, claim to have or mention the processes it uses to accomplish environmental product innovation?	Positive	Y/N	
17)	Noise Reduction	Does the company develop new products that are marketed as reducing noise emissions?	Positive	Y/N	
18)	Organic Products	Does the company report or show initiatives to produce or promote organic food or other products?	Positive	Y/N	
19)	Policy	Does the company have an environmental product innovation policy (eco-design, life cycle assessment, dematerialization)?	Positive	Y/N	
20)	Product Impact Controversies	Is the company under the spotlight of the media because of a controversy linked to the environmental impact of its products or services?	Negative	Y/N	
21)	Product Impact Minimization	Does the company reports about take-back procedures and recycling programmes to reduce the potential risks of products entering the environment? OR Does the company report about product features and applications or services that will promote responsible, efficient, cost-effective and environmentally preferable use?	Positive	Y/N	
22)	Renewable Energy Supply	Total energy distributed or produced from renewable energy sources divided by the total energy distributed or produced.	Positive	Number	Median
23)	Renewable/Clean Energy Products	Does the company develop products or technologies for use in the clean, renewable energy (such as wind, solar, hydro and geo-thermal and biomass power)?	Positive	Y/N	
24)	Sustainable Building Products	Does the company develop products and services that improve the energy efficiency of buildings?	Positive	Y/N	
25)	Water Technologies	Does the company develop products or technologies that are used for water treatment, purification or that improve water use efficiency?	Positive	Y/N	

Table A3
Firms' Disclosure of Thomson Reuters ASSET4 Line Items

This table shows averages of firms' disclosures of Thomson Reuters ASSET4 line items, measured as the number of reported line items divided by the number of possible line items a company could disclose. Numbers are shown for the overall environmental score as well as for the three category scores for the first and last year companies of a specific country are in the sample.

Country	First Year in Sample					Last Year in Sample				
	Year	Overall Score	Emission Reduction	Resource Reduction	Product Innovation	Year	Overall Score	Emission Reduction	Resource Reduction	Product Innovation
Australia	2004	0.69	0.71	0.64	0.72	2015	0.71	0.75	0.66	0.72
Austria	2005	0.72	0.76	0.69	0.71	2015	0.75	0.76	0.71	0.78
Belgium	2004	0.70	0.71	0.65	0.73	2015	0.75	0.79	0.70	0.74
Brazil	2007	0.71	0.74	0.71	0.70	2015	0.73	0.76	0.70	0.72
Canada	2004	0.71	0.73	0.65	0.75	2015	0.72	0.76	0.67	0.73
Switzerland	2004	0.75	0.79	0.70	0.77	2015	0.75	0.78	0.71	0.76
Chile	2008	0.77	0.84	0.71	0.76	2015	0.72	0.74	0.68	0.75
China	2004	0.72	0.76	0.68	0.74	2015	0.70	0.71	0.64	0.75
Colombia	2009	0.66	0.68	0.59	0.73	2015	0.72	0.73	0.70	0.72
Germany	2004	0.70	0.75	0.66	0.68	2015	0.78	0.83	0.74	0.78
Denmark	2005	0.70	0.76	0.68	0.68	2015	0.75	0.79	0.71	0.76
Egypt	2010	0.67	0.65	0.62	0.73	2015	0.66	0.64	0.61	0.72
Spain	2004	0.73	0.76	0.70	0.73	2015	0.79	0.83	0.80	0.74
Finland	2004	0.75	0.80	0.69	0.76	2015	0.84	0.91	0.81	0.80
France	2004	0.74	0.78	0.68	0.75	2015	0.82	0.88	0.79	0.78
UK	2004	0.73	0.76	0.66	0.77	2015	0.74	0.80	0.68	0.75
Greece	2004	0.65	0.62	0.66	0.66	2015	0.75	0.76	0.76	0.74
Hong Kong	2004	0.67	0.66	0.62	0.73	2015	0.71	0.73	0.67	0.74
Indonesia	2008	0.65	0.63	0.57	0.76	2015	0.72	0.73	0.69	0.73
India	2007	0.71	0.72	0.71	0.70	2015	0.73	0.75	0.68	0.74
Ireland	2004	0.67	0.71	0.62	0.68	2015	0.73	0.80	0.68	0.71
Israel	2008	0.71	0.76	0.71	0.68	2015	0.69	0.71	0.66	0.71
Italy	2004	0.70	0.72	0.66	0.71	2015	0.76	0.80	0.73	0.75
Japan	2004	0.71	0.70	0.64	0.78	2015	0.78	0.83	0.73	0.79
South Korea	2004	0.78	0.82	0.71	0.82	2015	0.77	0.81	0.74	0.77
Luxembourg	2004	0.68	0.72	0.65	0.69	2015	0.72	0.81	0.71	0.65
Mexico	2007	0.65	0.64	0.65	0.66	2015	0.78	0.83	0.75	0.76
Malaysia	2008	0.68	0.68	0.64	0.73	2015	0.72	0.74	0.67	0.76
Netherlands	2004	0.77	0.81	0.71	0.78	2015	0.77	0.80	0.72	0.78
Norway	2004	0.72	0.76	0.65	0.76	2015	0.78	0.85	0.75	0.75
New Zealand	2004	0.71	0.74	0.65	0.75	2015	0.71	0.74	0.65	0.73
Philippines	2009	0.70	0.70	0.64	0.78	2015	0.71	0.70	0.67	0.76
Poland	2008	0.66	0.65	0.63	0.69	2015	0.68	0.69	0.63	0.72
Portugal	2004	0.68	0.68	0.62	0.75	2015	0.73	0.78	0.71	0.71
Russia	2007	0.75	0.81	0.74	0.72	2015	0.77	0.82	0.74	0.74
Singapore	2004	0.70	0.70	0.63	0.78	2015	0.73	0.74	0.68	0.76
Sweden	2004	0.71	0.76	0.66	0.73	2015	0.78	0.82	0.74	0.78
Thailand	2008	0.73	0.75	0.69	0.75	2015	0.74	0.76	0.73	0.73
Turkey	2008	0.68	0.66	0.63	0.74	2015	0.76	0.79	0.71	0.76
Taiwan	2007	0.64	0.62	0.71	0.59	2015	0.72	0.75	0.66	0.75
South Africa	2008	0.72	0.75	0.72	0.69	2015	0.74	0.78	0.71	0.73
Overall		0.71	0.74	0.66	0.75		0.74	0.78	0.70	0.75

Table A4
Thomson Reuters ASSET4 ESG Governance Data

We create governance indicator variables based on the Thomson Reuters ASSET4 ESG governance indicator values (line items). Indicator values are the answers to Y/N questions, double Y/N questions, and numerical questions. We translate the answers to these questions into indicator variables. More specifically, for questions with a positive direction (i.e., a "yes" answer or a greater number is associated with better environmental performance), we translate the answers to Y/N questions into 0 (N) and 1 (Y); the answers to double Y/N questions into 0 (NN), 0.5 (YN or NY), and 1 (YY); and the answers to numerical questions into 0 (value is less (or equal) than zero; or value is less (or equal) than the median; see also column "Translation Numeric Values") and 1 (value is greater than zero; or value is greater than the median; see also column "Translation Numeric Values"). For questions with a negative direction (i.e., a "no" answer or a lower number is associated with better social performance), the opposite coding applies. The data are from the ASSET4 ESG database.

Items		Description	Direction	Question Type	Translation Numeric Values
A.	Board Functions				
1)	Policy	Does the company have a policy for maintaining effective board functions?	Positive	Y/N	
2)	Board Meeting Attendance	The average overall attendance percentage of board meetings as reported by the company.	Positive	Number	Median
3)	Succession Plan for Executives	Does the company have a succession plan for executive management in the event of unforeseen circumstances?	Positive	Y/N	
4)	External Consultants	Does the board or board committees have the authority to hire external advisers or consultants without management's approval?	Positive	Y/N	
5)	Audit Committee Independence	Percentage of independent board members on the audit committee as stipulated by the company.	Positive	Number	Median
6)	Audit Committee Management Independence	Does the company report that all audit committee members are non-executives?	Positive	Y/N	
7)	Compensation Committee Independence	Percentage of independent board members on the compensation committee as stipulated by the company.	Positive	Number	Median
8)	Compensation Committee Management Independence	Does the company report that all compensation committee members are non-executives?	Positive	Y/N	
9)	Nomination Committee Independence	Percentage of non-executive board members on the nomination committee.	Positive	Number	Median
10)	Nomination Committee Involvement	Percentage of nomination committee members who are significant shareholders (more than 5%).	Positive	Number	Median
B.	Board Structure				
1)	Policy	Does the company have a policy for maintaining a well-balanced membership of the board?	Positive	Y/N	
2)	Size of Board	Total number of board members which are in excess of ten or below eight.	Negative	Number	Median
3)	Background and Skills	Does the company describe the professional experience or skills of every board member? OR Does the company provide information about the age of individual board members?	Positive	Y/N	
4)	Board Diversity	Percentage of female on the board.	Positive	Number	Median
5)	Specific Skills	Percentage of board members who have either an industry specific background or a strong financial background.	Positive	Number	Median
6)	Experienced Board	Average number of years each board member has been on the board.	Positive	Number	Median
7)	Non-Executive Board Members	Percentage of non-executive board members.	Positive	Number	Median
8)	Independent Board Members	Percentage of independent board members as reported by the company.	Positive	Number	Median
9)	CEO-Chairman Separation	Does the CEO simultaneously chair the board or has the chairman of the board been the CEO of the company?	Negative	Y/N	
10)	Board Member Affiliations	Average number of other corporate affiliations for the board member.	Negative	Number	Median
11)	Individual Re-election	Are all board member individually subject to re-election (no classified or staggered board structure)?	Positive	Y/N	
C.	Compensation Policy				
1)	Policy	Does the company have a policy for performance-oriented compensation that attracts and retain the senior executives and board members?	Positive	Y/N	
2)	Compensation Improvement Tools	Does the company have the necessary internal improvement and information tools for the board members to develop appropriate compensation/remuneration to attract and retain key executives?	Positive	Y/N	
3)	CEO Compensation Link to Total Shareholder Return	Is the CEO's compensation linked to total shareholder return (TSR)?	Positive	Y/N	
4)	Total Senior Executives Compensation	The total compensation paid to all senior executives (if total aggregate is reported by the company).	Negative	Number	Median
5)	Shareholders Approval of Stock Based Compensation Plan	Does the company require that shareholder approval is obtained prior to the adoption of any stock based compensation plans?	Positive	Y/N	
6)	Individual Compensation	Does the company provide information about the total individual compensation of all executives and board members?	Positive	Y/N	
7)	Highest Remuneration Package	Highest remuneration package within the company in US dollars.	Negative	Number	Median
8)	Long Term Objectives	Is the management and board members remuneration partly linked to objectives or targets which are more than two years forward looking?	Positive	Y/N	

D.	Shareholder Rights				
1)	Policy	Does the company have a policy for ensuring equal treatment of minority shareholders, facilitating shareholder engagement or limiting the use of anti-takeover devices?	Positive	Y/N	
2)	Voting Cap Percentage	The percentage of maximum voting rights allowed or ownership rights.	Positive	Number	Median
3)	Majority Requirements for Election of Directors	Are the company's board members elected with a majority vote?	Positive	Y/N	
4)	Shareholders Vote on Executive Pay	Do the company's shareholders have the right to vote on executive compensation?	Positive	Y/N	
5)	Public Availability Corporate Statutes	Are the company's articles of association, statutes or bylaws publicly available?	Positive	Y/N	
6)	Veto Power or Golden Share	Does the biggest owner (by voting power) hold the veto power or own golden shares?	Negative	Y/N	
7)	State Owned Enterprise (SOE)	Is the company a State Owned Enterprise (SOE)?	Negative	Y/N	
8)	Voting Rights	Are all shares of the company providing equal voting rights?	Positive	Y/N	
9)	Anti Takeover Devices	The number of anti-takeover devices in place in excess of two.	Negative	Number	Zero

Table A5
Alternative Measures of Female Board Representation

This table reports regression estimates of environmental scores on governance measures, alternative measures of female board representation, and control variables. The dependent variables are the natural logarithm of environmental scores. The ASSET4 Environmental *z*-Score is a standardized score, calculated by and obtained from Thomson Reuters ASSET4 ESG, and measures firms' environmental performance relative to other companies in a given year. The Equally-weighted Environmental Score is the average of three category scores (Emission Reduction, Resource Reduction, and Product Innovation). Appendix Table A2 describes the indicator variables used to calculate the environmental scores. All other variables are described in Appendix Table A1. Control variables are included but not reported. The sample period is 2004-2015. All variables are winsorized at the 1st and 99th percentiles. All right-hand side variables are lagged by one year. Standard errors are clustered at the country-level and *t*-statistics are reported in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	ASSET4 Environmental *z*-Scores		Equally-weighted Environmental Scores	
	(1)	(2)	(3)	(4)
Family	-0.105***	-0.104***	-0.081***	-0.081***
	(-3.39)	(-3.34)	(-3.23)	(-3.18)
Traditional Governance	0.025**	0.023*	0.018*	0.016*
	(2.12)	(1.91)	(1.96)	(1.74)
Majority Election	0.082***	0.085***	0.068***	0.071***
	(3.49)	(3.67)	(3.62)	(3.80)
One Female Director	0.114***		0.086***	
	(3.74)		(3.90)	
Two+ Female Directors	0.206***		0.163***	
	(5.31)		(5.99)	
Percent Female Directors		0.628***		0.494***
		(4.11)		(4.48)
Controls	Yes	Yes	Yes	Yes
Country×Year Fixed Effects	Yes	Yes	Yes	Yes
Industry×Year Fixed Effects	Yes	Yes	Yes	Yes
Obs	20,447	20,447	20,447	20,447
Adjusted R^2	0.458	0.456	0.534	0.531

Table A6
Shocks to Female Board Representation

This table reports shocks to female board representation that we can examine using data from our sample period. Primary sources include regulatory websites, FACTIVA, industry reports of human resource consultancies, Deloitte (2017) and Fauver, Hung and Taboada (2019). We identify shocks that are either legislated female director quotas or represent a significant documented push by outside pressure groups. We exclude countries where quota legislation predates our sample period (e.g. Israel, Norway), or legislation occurs too late for post-treatment analysis (e.g. India, Spain).

Country	Year	Type	Description
Australia	2011	Push by outside pressure group and Legislation	ASX Corporate Governance Council updated its Corporate Governance Principals and Recommendations for diversity in Australia, the Australian Institution of Company Directors pushed for an increase in the number of female board members. In 2012, legislation passed to require mandated disclosure with measurable objectives to achieve gender diversity.
Belgium	2011	Legislation	33% quota by 2017.
Denmark	2012	Legislation	Measurable objectives by 2013. Comply or explain.
France	2011	Legislation	20% quota by 2014 and 40% by 2017.
Germany	2011	Push by outside pressure group	A group of 18 multinational German firms publicly commit to promote women into leadership positions (May 2010). A bipartisan parliamentary group issues *Berliner Erklaerung* with the goal of introducing a 30% female board representation quota (December 2011).
Italy	2011	Legislation	20% quota by 2012 and 33% by 2015.
Malaysia	2012	Legislation	Malaysian cabinet approved a 30% quota by 2016 for firms with more than 250 employees.
Netherlands	2011	Legislation	30% quota by 2013. Comply or explain if target not reached.
UK	2011	Push by outside pressure group	Lord Davies, a Labour government minister, published a report telling FTSE 100 companies they should double the number of female directors by 2015. This report was met with enthusiastic support publicly and from a number of shareholder organization. For example, one of the UK's largest shareholder organizations, the Association of British Insurers, disclosed that it would start monitoring the number of women on FTSE boards.