CEO origin and environmental performance of the firm

Abstract

The origin of a firm's CEO –insider or outsider – has long been recognized as crucial for its financial and innovation performance. We extend this discussion by demonstrating that insider CEOs are associated with better environmental performance than outsider CEOs. In exploring the drivers behind this observation, we find that firms with insider CEOs tend to invest more in innovative activities, which in turn leads to better environmental performance. This relation is particular pronounced during CEO turnover events, especially when an insider CEO replace an outsider CEO after two to three years. One implication of our findings is that investors who prefer to invest in firms with low regulatory- and reputational-risk may consider insider CEO-led firms potentially safer and sustainable investment options.

Keywords: insider CEO, outsider CEO, environmental performance, corporate governance

1. Introduction

The chief executive officer (CEO) plays a key role in organizational decisions and has important implications for a company's strategic change, financial performance, and future growth. Apart from characteristics such as knowledge and experience, the CEO's origin – whether promoted from within the firm (insider CEO) or hired from outside (outsider CEO) has also become one of the most significant factors for firms when they appoint a new CEO. Accordingly, examining the implications of insider vs outsider CEOs for a firm's strategic decisions and outcomes has received high attention. However, their scope is limited to the firm's financial and innovation performance, leading us to have little understanding of whether CEO origin matters to the firm's non-financial outcomes. This study aims to contribute to the extant literature by examining the association between CEO origin and a firm's environmental performance.

The extensive evidence in the extant literature highlights the association between a firm's CEO origin and financial outcomes, the empirical results are inconclusive. For example, several recent studies suggest that insider CEOs outperform outsider CEOs to improve a firm's financial performance, especially in a financial distress environment (Choi et al., 2023; Haque et al., 2022; Schepker et al., 2017; Zhang & Rajagopalan, 2010). Other studies support that outside CEOs lead to better financial performance as their expanded experience and knowledge (Georgakakis & Ruigrok, 2017; Helmich, 1977).

Certainly, it is undeniable that CEOs play an important role in shouldering the company's environmental responsibility and leading the strategy for improving environmental performance (Pujari et al., 2004; Shahrour et al., 2024; Sharma, 2000). As a demonstration of environmental responsibility, stakeholders increasingly expect a higher level of environmental performance from the company (e.g., Bhattacharyya & Cummings, 2015; Jiang & Fu, 2019; Kassinis & Vafeas, 2006). Superior environmental performance is a signal to the external

financial market that the company is fulfilling its responsibilities effectively, whereas, companies with inferior environmental performance are subject to greater political and social pressures from regulatory bodies (Patten, 2002). Researchers attempted to explore the factors that affect the company's environmental performance, where the external pressures and firm characteristics have been identified, including pressures from various stakeholders, firm size, and industry sectors. Meanwhile, corporate governance features such as the CEO's duality as the chairman (Velte, 2019), CEO experience (O'Sullivan et al., 2021; Xu & Ma, 2021; Zappalà, 2020), CEO ownership (Shahrour et al., 2024), board size and board independence (De Villiers et al., 2011; Ibrahim et al., 2003; Saeed et al., 2024), have also been highlighted that can impact corporate environmental responsibilities.

Moreover, the intention of changing leadership is deemed not only to maintain the firm's economic and financial health but also to ensure better achievement in non-financial performance (Bernard et al., 2018; Meng et al., 2013). To achieve a higher non-financial performance, companies focus on environmental, social, and governance metrics, to ensure long-term sustainability and value creation (Shahrour et al., 2024). This enhances company reputation (Dangelico, 2015), stakeholder engagement (Bhattacharyya & Cummings, 2015), regulatory compliance , and risk management (Dobler et al., 2014; Kim & Park, 2020). Further, the companies with higher environmental performance attract socially responsible investors, foster innovation, meet consumer demand for sustainable products, and provides a competitive advantage, ultimately leading to sustainable business success (Lee et al., 2015; Yadav et al., 2017). Hence, it is crucial for the company to comprehend how a firm's environmental performance varies under insider versus outsider CEOs.

Ex-ante, the association between CEO origin and environmental performance is difficult to predict. On the one hand, outsider CEOs are appointed, especially when the firm is undergoing severe financial distress and an immediate strategic change is required (Cannella

Jr & Lubatkin, 1993). Such a context may lead the outsider CEO to refrain from investments in innovative activities (Gilson et al., 1990; John, 1993; Ofek, 1993). As innovation activities help reduce toxic emissions and carbon footprints (Carrión-Flores & Innes, 2010), outsiders may fall short of insider CEOs in their environmental performance.

On the other hand, outsider CEOs bring extensive external knowledge, networks and information which equip them with capabilities to expand the resource base of the firm and promote innovation and performance (Georgakakis & Ruigrok, 2017; Menon & Pfeffer, 2003). They also bring novel strategic perspectives (Shen & Cho, 2005) which helps firms align internal resources with the external environmental requirements (Schepker et al., 2017). Further, the compensation structure of outsider CEOs comprises more equity-based pay than that of insider CEOs (Palomino & Peyrache, 2013; Zheng, 2010). As equity-based compensation fosters socially responsible investments (Mahoney & Thorn, 2006), outsider CEOs may outperform insider CEOs in their environmental performance.

Based on a sample of 19,139 firm-year observations from 2002 to 2019 in the U.S., we find that insider CEOs outperform outsider CEOs in their firms' environmental performance. The margin of outperformance is equal to 2.84 points. In further analysis, we consider CEO turnovers and find evidence of improved environmental performance after an insider CEO takes office from an outsider. In exploring possible mechanisms driving our key finding, we find that firms with insider CEOs prioritize innovation investments, contributing to their superior environmental performance compared to firms with outsider CEOs.

While much attention has been given to CEO origin in relation to a firm's financial performance and innovation outcomes (e.g., Georgakakis & Ruigrok, 2017; Haque et al., 2022; Zhang & Rajagopalan, 2010), its association with non-financial performance metrics remains largely unexplored. This study contributes to the extant literature by providing new evidence

that CEO origin matters to a firm's non-financial performance in the form of environmental performance. Given that a firm's environmental performance is associated with how the external auditors assess audit risks (Rabarison et al., 2024), credit rating agencies rate that firm (Hu et al., 2024), it is important for the investors to identify easily accessible and identifiable CEO characteristics. As investors can quickly identify based on the CEO profile on the company's annual report/website whether he/she is promoted from within or hired from outside, we provide a yardstick that they can see to have preliminary ideas on the firm's future environmental performance.

This paper is structured as follows. Section 2 reviews the literature and develops hypotheses. Section 3 describes the study's sample and model development, and Section 4 presents and discusses the results. Finally, Section 5 summarises this study and draws conclusions.

2. Theoretical framework and Hypotheses

The relationship between the origins of a CEO and a firm's environmental performance can be understood in two folds. On one side, environmental performance is not only a concern for one or two social groups, but it matters for all stakeholders of an organization if the company wants to create long-term value (Bhattacharyya & Cummings, 2015). Second, the CEO plays an important role in shaping the company's strategic direction within an organisation. CEOs from different origins tend to shape the company's future direction based on their background (Datta & Guthrie, 1994; Karaevli & Zajac, 2013). For example, internally promoted CEOs are more likely to maintain the same strategies as the company had, whereas externally hired CEOs may be prone to make significant changes to the company's future strategic directions (Zhang & Rajagopalan, 2010). Thus, two competing theories (i.e. adaptation and disruption) are

employed to understand the companies' environmental performance led by CEOs from different origins.

Firstly, stakeholder theory provides a comprehensive framework for understanding and enhancing firms' environmental performance, emphasising the importance of addressing the interests of all stakeholders. This theory, introduced by Freeman (2010) and Friedman and Miles (2002), suggests that firms must consider not only shareholders but also employees, customers, suppliers, communities, and environmental entities. Aguinis and Glavas (2012) highlight that effective stakeholder engagement leads to improved environmental practices, as stakeholders demand greater transparency and accountability in environmental management. For instance, Bhattacharyya and Cummings (2015) demonstrate that firms actively involving stakeholders in environmental initiatives tend to achieve better corporate environmental performance. This involvement includes robust communication and collaboration with employees, who play a significant role in implementing sustainable practices, as evidenced by Dangelico (2015)'s study on employee green teams.

The relationship between various stakeholders and environmental performance is further emphasized through the influence of corporate governance and investor responses. Choi et al. (2013) found that companies with strong governance structures are more likely to provide high-quality environmental disclosures. Saeed et al. (2024) support this by demonstrating that appointing independent directors can have a positive impact on environmental performance through enhanced oversight. Similarly, Michelon and Parbonetti (2012) also indicate that disclosing the social and environmental impact of corporate activities is expected by stakeholders, which indeed deemed to improve the company's transparency. Furthermore, Cordeiro and Tewari (2015) argue that companies engaging proactively with stakeholders on environmental issues tend to experience more favorable market reactions, aligning financial performance with environmental objectives. This alignment is also supported by Fatemi et al.

(2018), who shows that strong environmental performance, combined with transparent disclosures, significantly increases firm value, Hu et al. (2024) who reveal that firm's environmental performance contribute to their credit rating, and Rabarison et al. (2024) wo demonstrate that high environmental performed firm are less likely to exposed to business risk. Collectively, prior studies indicate that stakeholder theory not only offers a strong framework for comprehending the dynamics of environmental performance but also highlights practical pathways for companies to achieve sustainable success by incorporating stakeholder concerns into their strategic planning.

The impact of CEO origin, whether an insider or an outsider, on firms' environmental performance is a significant area of inquiry, influenced by competing theoretical perspectives. Disruption theory posits that the change in leadership is associated with significant disturbance within the organisation, and the potential benefits associated with the appointment of an external CEO may not offset the disruption costs stemming from such significant change (Ballinger & Marcel, 2010; Boeker, 1992; Grusky, 1963). The impact of outsiders depends on the stability of the firm, Karaevli and Zajac (2013) demonstrate that stable conditions can be enablers for strategic change for an outsider CEO, whereas, unstable conditions can be barriers of change. Moreover, the high level of strategic change implemented by outsiders may not have a positive effect on the firm performance (Zhang & Rajagopalan, 2010).

In contrast, appointing an internal leader is favoured by the board of directors to maintain the status quo. Internal appointed CEO is expected to lead to various benefits, such as reduced costs associated with socialization, turnover, and poor hiring decisions (Zajac, 1990), as well as an increased capacity to attract and retain employees (Friedman, 1991). According to Furtado and Rozeff (1987), there are multiple advantages to promoting employees from within, including a lower level of disruption to the organization, stimulation of the management team, the avoidance of negative signalling, greater knowledge of internal managers, and a reduced

risk of making a poor appointment due to their specific human capital being aligned with the firm.

Additionally, CEOs who have been with the company for a long time are considered to have the ability to create loyalty and inspire future candidates. They can leverage their insider knowledge and connections, minimize organizational turbulence, and reduce information asymmetry (Choi et al., 2023; Haque et al., 2022). Therefore, they tend to be more concerned about the long-term success of the company compared to externally hired CEOs (Schepker et al., 2017). When determining whether to hire a new CEO from outside the organization or promote an internal candidate, firms take into account the influence of their long-term objectives and the importance of innovativeness. Studies have shown that bringing in external leaders often results in a decline in overall innovation, as their main focus tends to be on improving firm performance after the appointment, typically assessed through accounting-based metrics (Gilson et al., 1990; John, 1993; Ofek, 1993). Consequently, this approach may lead to substantial cost savings through employee layoffs, asset and debt restructuring, and a reduction in investments in innovative projects (Balsmeier et al., 2013). For instance, Balsmeier and Buchwald (2015) investigated whether insider or outside CEOs were more likely to promote innovation within the company. They studied a sample of the 100 largest German companies from 2000 to 2008 and found that CEOs who were promoted from within the company were strongly associated with higher levels of innovation compared to those hired from outside who do not prioritise innovation in the first place. Moreover, in the same vein, a study by Cummings and Knott (2018) has also demonstrated similar findings by using US publicity firms from 1992 to 2013. They find that firm R&D productivity decays during the tenure of outside CEOs relative to that of insider CEOs. Thus, insider CEOs are deemed to have a better position to improve environmental performance due to their extensive understanding of the firm's internal dynamics and established relationships. This familiarity

enables them to build on existing environmental strategies and ensure a smoother implementation of sustainability initiatives to pursue long-term survival. Therefore, according to disruption theory, we posit that insider CEOs' deep organizational knowledge, continuity in strategic vision, and strong internal networks enable them to implement effective environmental strategies. Further, their familiarity with the firm's culture and processes allows for the seamless integration of sustainability initiatives, leading to superior environmental performance. The below hypothesis is proposed:

H1: Firms led by insider-promoted CEOs exhibit higher environmental performance compared to firms led by outsider CEOs.

From an adaptation perspective, hiring an external CEO offers an opportunity for companies to realign their strategy and resources with the external environment (Shen & Cho, 2005). Over time, positive benefits from this adaption emerge as new CEOs learn and acclimate to their role (Hambrick & Fukutomi, 1991). Companies are more likely to appoint an external CEO during financial crises or unfavourable conditions when significant strategic changes are necessary to improve the situation (Datta & Guthrie, 1994). Consequently, outsider CEOs typically focus on cost reduction during the early part of their tenure, contributing to immediate financial performance, while the more substantial long-term benefits become apparent in later years (Jalal & Prezas, 2012).

Moreover, the impact of an external CEO should be viewed more comprehensively. A study by Georgakakis and Ruigrok (2017) suggests that the performance outcomes related to a new CEO's background should not be assessed in isolation but rather in conjunction with various multilevel characteristics. Specifically, they found that the performance advantages of external succession are realized when the new CEO shares socio-demographic similarities with incumbent executives, possesses a diverse range of experiences, and is appointed by a

performing firm within a supportive industry. This view is further reinforced by Garcia-Blandon et al. (2019), who find that outsider CEO outperform insider CEOs in both financial and non-financial performance. Jalal and Prezas (2012) also support this perspective, demonstrating that outsider CEOs–particularly those are hired from different industry–often generate superior performance by overcoming entrenched practices and introducing innovative sustainability measures.

In the same vein, Bernard et al. (2018) examine the relationship between CEO origin and corporate sustainability performance. Analysing panel data from 88 public companies in France over 13 years, they find that a change of CEO positively and significantly impacts a company's sustainability performance five years post-change. This positive effect is especially pronounced when the new CEO is an external hire.

Thus, according to adaptation theory, outsider CEOs bring fresh perspectives, diverse experiences, and a willingness to challenge the established norms, leading to innovative and effective environmental strategies. Their detachment from existing organisational practices enables them to implement bold changes that can markedly enhance environmental performance. Therefore, we expect that:

H2: Firms led by outsider-hired CEOs exhibit higher environmental performance compared to firms led by insider CEOs.

3. Data and method

3.1 The sample

The sample is drawn from firms (including those in the non-financial and non-utility industries) in the U.S. from 2002 to 2019. The firm's environmental performance and financial data are obtained from Refinitiv's Eikon and DataStream, respectively. CEO and board characteristics data are from BoardEx. After dropping observations with missing values, we

have a final sample of 19,139 firm-year observations from 3,353 unique firms. A distribution of this sample by year is provided in Panel A of Table 1.

[Insert Table 1 Here]

3.2 Regression model and variables

We run Equation (1) based on ordinary least squares (OLS) regression to test whether there is a difference in environmental performance between firms run by insider and outsider CEOs.

$$Env\ Score_t = \alpha + Insider\ CEO_t + Control\ Variables_t + Industry\ Fixed\ Effects + Year\ Fixed\ Effects + Country\ Fixed\ Effects + \epsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The dependent variable in Equation (1) is the firm's environmental performance (*Env Score*). The *Env Score* signifies the firm's effectiveness in three areas: resource use, emissions, and innovation (Naeem et al., 2022). The values for *Env Score* range from 0 to 100, where higher scores indicate better performance. The independent variable of interest is *Insider CEO*, a dummy variable set to 1 if the CEO had worked for two years or more[1] in the same firm prior to becoming the CEO, and 0 otherwise (Haque et al., 2022; Zhu & Shen, 2016).

In line with prior research (e.g., Oyewo, 2023), Equation (1) includes the following control variables: firm size (*Ln Assets*), capital structure (*Leverage*), level of research and development intensity (*R&D Intensity*), cash holding (*Cash*), financial (return on assets – *ROA*) and market- (*Tobin's Q*) performance. It also includes control for the board and CEO characteristics: number of directors (*Board Size*), the ratio of independent directors (*Board Independence*), the ratio of female directors (*Female Directors*), the ratio of busy directors

[1] Our key inference remains the same if we define *Insider CEO* based on one-year or more working experience in the same firm prior to becoming the CEO.

(Board Busyness), CEO's age (*Ln CEO Age*), experience in current role (*Ln CEO Tenure*), and duality (*CEO Duality*). All variables are defined in Appendix A.

3.3 Descriptive statistics and correlation

Panel B of Table 1 presents descriptive statistics of the variables used in this study. It shows that the average firm's *Env Score* is 24, with a considerable variation across firms as indicated by the standard deviation. Insider CEOs run 90% of our sample firms. The average firm has a debt level of around 25% of total assets, spends 17% of total sales in research and development activities, holds 9% of total assets in cash, and reports a 2.6% *ROA*. The average number of directors in a board is 10; around 80% of them are independent, and 16% are female directors. The CEO is also the board chair in around 43% of the sample firms.

Panel C of Table 1 reports the correlation matrix. The correlation between the firm's environmental performance (*Env Score*) and *Insider CEO* is significantly positive, providing preliminary evidence supporting that CEOs promoted from within the firm report better environmental performance than those hired from outside. The correlation among the control variables ranges from low to moderate, indicating that multicollinearity is unlikely to be a concern in our multivariate regressions. This is further supported by an average variance inflation factor of 1.42 in the baseline regression model.

4. Results

4.1 Main results

Table 2 reports the regression results estimated based on Equation (1), in which we add control variables progressively. The results across columns consistently show a significantly positive association between *Insider CEO* and *Env Score*. This result suggests that firms with CEOs promoted from within perform better environmental performance compared to those who hire CEOs from outside. According to Column 3, the environmental performance of firms run by insider CEOs is, on average, 2.84 points higher than that of firms run by outsider CEOs.

We use the help of prior research related to this to measure the economic significance of this differential in a firm's environmental performance. For instance, Hu et al. (2024) document that a one-standard-deviation (=28.6842) increase in a firm's environmental performance is associated with a 1.6349-point increase in credit ratings. As such, a 2.84-point differential in environmental performance in our result will lead to a 0.16-point differential in credit ratings.

The coefficients of the control variables align with the extant literature. For instance, the coefficient of *Ln Assets* is positive and significant, confirming that larger firms report better environmental performance because they hold more economic resources and attract more community scrutiny than smaller firms (Drempetic et al., 2020). The coefficient of *R&D Intensity* is significantly positive, indicating high environmental performance in high R&D-intensive firms. This is perhaps because investment in R&D helps firms create green and eco-friendly innovations. This innovation channel may explain why insiders trump outsiders in their environmental performance, which we explore in Section 4.2. Interestingly, their insignificant coefficients suggest that the CEO characteristics (*Ln CEO Age*, *Ln CEO Tenure*, and *CEO Duality*) are not associated with the firm's environmental performance.

[Insert Table 2 Here]

One can argue that the *Insider CEO* variable is endogenous because a firm's environmental performance may influence its decision to promote an executive from within to the CEO position or hire someone from outside. Unobserved variables (such as the CEOs' innate ability) may also impact such a decision. While our key finding continues to hold if a one-year or two-year lagged value of *Insider CEO* and control variables are used in the regression, we consider CEO turnover events (insider to outsider or outsider to insider) and study the firm's post-succession environmental performance compared to pre-succession. Our sample identifies 1,498 CEO turnover events, of which 1,012 (486) are changes from outsider

to insider (insider to outsider) CEOs. We create four dummy variables: *Outsider to Insider1*, which is coded as one for the year after an outsider CEO is succeeded by an insider CEO, and zero for the year before. To illustrate, if an outsider CEO is succeeded by an insider CEO in 2015, then it is coded as one for 2016 and zero for 2014. We also consider two-year (*Outsider to Insider2*) and three-year windows (*Outsider to Insider3*) because prompt changes in the firm's strategic actions (such as investment in R&D) are unrealistic. Hence, a firm's environmental performance change may not be observed in a shorter window. In defining *Outsider to Insider1*, *Outsider to Insider2*, and *Outsider to Insider3*, we ensure the same outsider (insider) CEO led the firm in the pre- (post) succession period. We insert these variables in separate regressions in Equation (1) and report the results in Panel A of Table 3.

The coefficient of *Outsider to Insider1* in Column 1 is insignificant, indicating no changes in the firm's environmental performance in the year after an insider CEO takes office from an outsider CEO. Interestingly, the coefficients of *Outsider to Insider2* in Column 2 and *Outsider to Insider3* in Column 3 are significantly positive. This implies improved environmental performance in the two-year and three-year periods after an insider CEO leads the firm compared to the same period led by an outsider CEO.[2]

Conversely, we consider cases when an outsider CEO takes office from an insider CEO. Using a similar approach, we insert three dummy variables: *Insider to Outsider1*, *Insider to Outsider2*, and *Insider to Outsider3* in Equation (1). The results are reported in Panel B of Table 3. The coefficients of all three dummies across columns are insignificant, indicating no changes in environmental performance when a firm undergoes a change from insider to outsider CEO. As suggested by Liu and Xue (2020), this is possibly because after taking office,

[2] We noted the same finding in four- and five-year windows.

an outsider CEO puts more emphasis on short-term financial performance over investment in innovation activities.

In sum, the results in Table 3 suggest an improved environmental performance when an insider CEO succeeds an outsider CEO, supporting our key inference in Table 2.

[Insert Table 3 Here]

4.2 Potential mechanism

While we find that insider CEOs outperform outsider CEOs in their environmental performance, a natural question is what drives such an outcome. Prior research documents that innovation activities lead to the generation of eco-friendly outputs, which, in turn, result in better environmental performance (Uyar et al., 2023). Further, insider CEOs are associated with higher innovation activity than outsider CEOs (Balsmeier & Buchwald, 2015; Liu & Xue, 2020). In keeping with these findings, investment in innovative activities could be a possible lens to explain our key finding in Table 2. We initiate this test in two phases.

In the first phase, we examine whether, compared to outsider CEOs, firms with insider CEOs initiate more innovative activities, proxied by investment in R&D. We scale R&D by total assets and then create a dummy variable – *High R&D* – which is set to one if the firm's R&D in a year is greater than the industry median and zero otherwise. Then, we run a logit regression as shown in Equation (2).

$$High\ R\&D_t = \alpha + Insider\ CEO_t + Control\ Variables_{t-1} + Industry\ Fixed\ Effects + Year\ Fixed\ Effects + Country\ Fixed\ Effects + \epsilon \quad (2)$$

The results of Equation (2) are reported in Column 1 of Table 4. The coefficient of *Insider CEO* is positive and significant, suggesting that firms run by CEOs promoted from within make more investments in innovation activities than those run by CEOs hired from

outside. This finding aligns with the one reported in prior research (e.g., Balsmeier & Buchwald, 2015; Liu & Xue, 2020).

In the second phase, we investigate whether high innovation activities by insider CEOs contribute to their firm's reporting better environmental performance. In doing so, we estimate Equation (3). If innovation is a potential channel contributing to better environmental performance in insider CEO-led firms, then we expect the interaction between *Insider CEO* and *High R&D* to be positive and significantly different from zero.

$$Env\ Score_t = \alpha + Insider\ CEO_t + High\ R\&D_t + Insider\ CEO_t * High\ R\&D_t + Control\ Variables_t + Industry\ Fixed\ Effects + Year\ Fixed\ Effects + Country\ Fixed\ Effects + \epsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

The results of Equation (3) are reported in Column 2 of Table 4. The coefficient of *High R&D* is significantly positive, implying better environmental performance in firms with more innovative activities. Notably, the coefficient of *Insider CEO*High R&D* is also positive and significant. This indicates that insider CEOs-led firms report better environmental performance when they invest more in innovation, which they do as per the results in Column 1. Thus, the results in Table 4 support the notion that insider CEOs make more innovative efforts than outsider CEOs, and this strategic action leads them to generate better environmental performance.

[Insert Table 4 Here]

4.3 Alternative explanation

Some prior research suggests that a firm hires a CEO from outside when the firm performs poorly compared to other firms in the industry and needs to turn the wheel around (e.g., Chung et al., 1987). We indeed noticed that the average ROA of outsider CEO-led firms is significantly lower than those of insider CEO-led firms (-0.0252 vs. 0.0312, $p < 0.001$). Under poor performance conditions, outsider CEOs may have less of a choice to invest in

environmentally friendly activities, leading to low environmental performance. In other words, poor performance conditions may have enabled us to find lower environmental performance in the outsider CEO sample compared to the high-performing insider CEO-led sample. Thus, we would like to test if this lens is relevant to explaining our key finding in Table 2. To test this, we consider firm performance in the past two and three years and create two dummy variables. *High ROA Past 2Y* (*High ROA Past 3Y*) is set to 1 if the firm's ROA in the past two (three) years is above the industry median and zero otherwise. These dummies are then interacted separately with the *Insider CEO* dummy in Equation (1). If poor performance contributed to finding the shortfall in outsider CEO firms, then the domination of insider CEO firms' environmental performance is expected to be pronounced under high-performing conditions. The regression results are reported in Columns 1 and 2 of Table 5.

The coefficient of *High ROA Past 2Y* (Column 1) and *High ROA Past 3Y* (Column 2) is significantly positive, implying better environmental performance in firms with high performance in the past years. The coefficient of *Insider CEO* is significantly positive in both columns. However, its interaction with the firm's past performance dummies is insignificant. This indicates no differential in environmental performance depending on insider and outsider CEO-led firms' financial performance in the past years. Thus, while the literature suggests that outsider CEOs are appointed particularly under poor financial performance conditions, this lens does not explain why such firms fall short of insider CEO-led firms in their environmental performance.

[Insert Table 5 Here]

4.4 Firm value

Our finding that insider CEO-led firms report better environmental performance than outsider CEO-led firms interests us to ask whether it benefits the former. Specifically, we examine the joint effects of insider CEOs and environmental performance on the firm's future

financial and marked-based outcomes in the form of one-year forward *ROA*, *Tobin's Q*, *Stock Returns*, and market-to-book (*MB*) ratio. We create a dummy variable – *High Env Score* – which is set to one if the firm's *Env Score* in a year is greater than the industry median and zero otherwise. We interact this dummy with the *Insider CEO* dummy, putting those financial and market-based outcomes as dependent variables in the regression. The results are presented in Table 6.

Interestingly, except for the MB regression in Column 4, the interaction term coefficient across columns is insignificant, suggesting that insider CEO-led firms add no additional value through their environmental performance. The coefficient of the *High Env Score* is significantly positive in the *ROA* regression (Column 1) but not in other regressions. This implies that while there is an implication of high environmental performance on financial performance, the market does not capture/reflect such information. This aligns with prior research documenting no market reaction to the firm's announcements of environmental initiatives and any awards/certifications received (e.g., Jacobs et al., 2010)

[Insert Table 6 Here]

4.5 Robustness tests

Although we found earlier that poor firm performance in outsider CEO-led firms does not guide us in finding low environmental performance, differences in their other operating characteristics compared to insider CEO-led firms could play a role in that finding. Further, as indicated earlier, unobserved CEO characteristics (such as innate ability) that we cannot measure and control for in the regression may influence our results. To address these potential concerns, we apply the following approaches. First, we employ propensity score matching (PSM) to match insider CEO-led firms' characteristics to those of outsider CEO-led firms. We run a logit regression in which the dependent variable is the *Insider CEO* dummy and include all control variables (excluding year and industry fixed effects) from the baseline regression in

Table 2. This regression enables us to match the two groups of firms. We match without replacement and using a caliper of 0.01%, leading to 1,185 matched pairs. In the *t*-test results reported in Appendix B, we find that, except for the *Ln CEO Age*, the mean of covariates in insider CEO sample firms is statistically indifferent to the mean of outsider CEO sample firms. According to the results in Column 1 of Table 7, insider CEO-led firms report a margin of 3.38 points in their environmental performance over outsider CEO-led firms, even though the average firm in both groups shared the same characteristics. Thus, we find no evidence to suggest that a differential in their financial performance has contributed to a difference in insider vs. outsider CEO-led firm's environmental performance. Second, we measure the firm's environmental performance based on data in the KLD database and run the baseline regression. Our key finding remains unchanged in this alternative dataset (see results in Column 2). Third and finally, we include CEO fixed effects in the baseline regression that are expected to control for unobserved CEO characteristics such as ability. Again, we find a significantly positive coefficient of *Insider CEO* (Column 3), confirming the robustness of our key finding.

[Insert Table 7 Here]

5. Conclusion

This study examines whether CEO origin (insider or outsider) makes a difference to the firm's environmental performance. Based on an US sample of 19,139 firm-year observations from 2002 to 2019, we find that insider CEOs outperform outsider CEOs by 2.84 points in their firms' environmental performance. While prior research mainly focused on the association between the firm's CEO origin and financial performance and document that firms with insider CEOs report better financial performance than outsider CEOs (e.g., Haque et al., 2022), the incremental knowledge this study presents is that firms also report better non-financial performance under the leading of insider CEOs. In particular, we also observe that insider

CEOs outperform in environmental performance when they take over the role from an outsider CEO.

This study also underscores that a firm leading by an insider CEO is more likely to have innovation activities and eventually leads to higher environmental performance. Given our finding that insider CEOs outperform outsider CEOs in environmental performance, strategic hiring decisions should weigh the benefits of internal promotion versus external hires, especially in industries where environmental sustainability is critical. Furthermore, investors who prefer to invest in firms with lower regulatory and reputational risk might be interested in our findings. They may find insider CEO led firms potentially safer and more sustainable investment option.

While we acknowledge that outsider CEOs are often appointed during times of poor firm performance, which may contribute to their comparative underperformance in environmental performance relative to insider CEOs, it raises the questions of whether they deprioritize the firm's non-financial performance to achieve a turnaround. We leave this question to be explored by future research.

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Appendix A: Variable definition

Env Score	Environmental performance score
Insider CEO	Dummy variable set to 1 if the CEO had worked for two years or more in the same firm prior to becoming the CEO and 0 otherwise
Ln Assets	Log of total assets
Leverage	Long-term debt/total assets
R&D Intensity/Innovation	Research and development expenditure/sales
Cash	Cash/total assets
Capex Intensity	Capital expenditure/sales
ROA	Net profit/total assets
Tobin's Q	(Market value of equity + total liabilities)/total assets
Board Size	Number of directors on the board
Board Independence	Number of independent directors/number of directors on the board
Female Directors	Number of female directors/number of directors on the board
Board Busyness	Number of directors holding three or more boards/number of directors on the board
Ln CEO Age	Log of CEO age
Ln CEO Tenure	Log of CEO tenure
CEO Duality	Dummy variable set to 1 if the CEO is also the board chair, 0 otherwise
High R&D	Dummy variables set to 1 if the firm's *R&D Intensity* is greater than the industry median, 0 otherwise

Appendix B: Covariate balance after PSM

Variable	Insider CEO sample		Outsider CEO sample		Mean Diff. (p-value)
	Obs.	Mean (a)	Obs.	Mean (b)	
Ln Assets	1,185	14.8879	1,185	14.8873	0.0006 (0.99)
Leverage	1,185	0.2569	1,185	0.2528	0.0041 (0.71)
R&D Intensity	1,185	0.2999	1,185	0.3022	-0.0022 (0.97)
Cash	1,185	0.1095	1,185	0.1099	-0.0004 (0.95)
ROA	1,185	-0.0024	1,185	-0.0010	-0.0014 (0.83)
Tobin's Q	1,185	0.5798	1,185	0.5828	-0.0030 (0.75)
Board Size	1,185	9.3519	1,185	9.4110	-0.0591 (0.54)
Board Independence	1,185	77.6470	1,185	78.4180	-0.7709 (0.15)
Female Directors	1,185	15.2712	1,185	15.1427	0.1285 (0.77)
Board Busyness	1,185	0.2403	1,185	0.2303	0.0100 (0.19)
Ln CEO Age	1,185	4.0767	1,185	4.0878	-0.0111 (0.02)
Ln CEO Tenure	1,185	0.0840	1,185	0.0387	0.0453 (0.15)
CEO Duality	1,185	0.2219	1,185	0.2464	-0.0245 (0.16)

Table 1: Sample distribution and descriptive statistics

This table presents the sample distribution by year (Panel A), descriptive statistics of the sample (Panel B), and correlation matrix of the variables used in the baseline regression (Panel C). All continuous variables are winsorized at the 1% and 99% levels.

Panel A: Sample distribution by year

Year	Obs.	%	Year	Obs.	%
2002	363	1.9	2011	846	4.42
2003	360	1.88	2012	840	4.39
2004	491	2.57	2013	852	4.45
2005	568	2.97	2014	815	4.26
2006	560	2.93	2015	1,362	7.12
2007	570	2.98	2016	1,946	10.17
2008	724	3.78	2017	2,313	12.09
2009	833	4.35	2018	2,385	12.46
2010	853	4.46	2019	2,458	12.84
			Total	**19,139**	**100%**

Panel B: Descriptive statistics

Variable	Obs.	Mean	SD	Min	Max
Env Score	19,139	24.2512	26.1533	0.0000	89.2400
Insider CEO	19,139	0.9063	0.2915	0.0000	1.0000
Ln Assets	19,139	15.2918	1.6909	9.7709	19.0968
Leverage	19,139	0.2504	0.1921	0.0000	0.8093
R&D Intensity	19,139	0.1730	1.0188	0.0000	9.6192
Cash	19,139	0.0901	0.1245	0.0000	0.7984
ROA	19,139	0.0259	0.1278	-0.8780	0.2732
Tobin's Q	19,139	0.5857	0.2218	0.0472	0.9975
Board Size	19,139	9.7484	2.3600	4.0000	16.0000
Board Independence	19,139	79.9074	11.7714	29.4118	92.3077
Female Directors	19,139	15.7502	10.1886	0.0000	40.0000
Board Busyness	19,139	0.2285	0.1861	0.0000	0.7273
Ln CEO Age	19,139	4.1250	0.1143	3.7542	4.4164
Ln CEO Tenure	19,139	1.1126	1.1283	-2.3026	3.3638
CEO Duality	19,139	0.4296	0.4950	0.0000	1.0000

Panel C: Correlation matrix

	Variable	1	2	3	4	5	6	7	8
1	Env Score $_t$	1							
2	Insider CEO	0.0964*	1						
3	Ln Assets	0.5293*	0.1212*	1					
4	Leverage	0.0900*	0.005	0.1709*	1				
5	R&D Intensity	-0.1245*	-0.0624*	-0.2818*	-0.1095*	1			
6	Cash	-0.1347*	-0.0937*	-0.4367*	-0.2197*	0.3315*	1		
7	ROA	0.1706*	0.1286*	0.2655*	-0.0362*	-0.5788*	-0.2299*	1	
8	Tobin's Q	0.1521*	0.0159*	0.4226*	0.4631*	-0.1633*	-0.3360*	-0.0634*	1
9	Board Size	0.3713*	0.0731*	0.5973*	0.0098	-0.1444*	-0.2779*	0.1375*	0.3293*
10	Board Independence	0.2279*	0.0809*	0.1349*	0.0248*	-0.0087	-0.0288*	0.0119	0.1202*
11	Female Directors	0.2819*	0.0311*	0.1826*	0.0350*	-0.0412*	-0.0407*	0.0587*	0.1275*
12	Board Busyness	0.2517*	-0.0003	0.3033*	0.0637*	0.0482*	-0.0045	0.014	0.0107
13	Ln CEO Age	0.0388*	0.1330*	0.0703*	-0.0014	-0.0402*	-0.0965*	0.0535*	0.0634*
14	Ln CEO Tenure	-0.0190*	0.3758*	-0.0206*	-0.0309*	-0.0210*	-0.0301*	0.0719*	-0.0250*
15	CEO Duality	0.0647*	0.1476*	0.1702*	0.0218*	-0.0799*	-0.1123*	0.0856*	0.0743*

	Variable	9	10	11	12	13	14	15
9	Board Size	1						
10	Board Independence	0.1222*	1					
11	Female Directors	0.1778*	0.2642*	1				
12	Board Busyness	0.1900*	0.1468*	0.0978*	1			
13	Ln CEO Age	0.0473*	-0.0194*	0.0089	-0.0594*	1		
14	Ln CEO Tenure	-0.0617*	0.0216*	-0.0448*	-0.0903*	0.2826*	1	
15	CEO Duality	0.0674*	0.0913*	-0.0072	0.0930*	0.2590*	0.1753*	1

* Significant at 5% level or better.

Table 2: Baseline regression

This table reports regression results on the association between CEO origin and firm environmental performance. *Insider CEO* is a dummy variable set to 1 if the CEO had worked for two years or more in the same firm before becoming the CEO and 0 otherwise. *Env Score* represents the firm's environmental performance, in which a higher score indicates better performance. All other variables are defined in Appendix A. Heteroscedasticity-robust standard errors are in parentheses, clustered by firm. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)
	Env Score	Env Score	Env Score
Insider CEO	2.9648***	2.6679***	2.8367***
	(0.5637)	(0.5584)	(0.5961)
Ln Assets	10.4700***	8.2803***	8.2750***
	(0.2914)	(0.3133)	(0.3134)
Leverage	-10.1675***	-6.6969***	-6.6826**
	(2.8295)	(2.5943)	(2.5939)
R&D Intensity	1.0465***	0.7501**	0.7560**
	(0.2767)	(0.3167)	(0.3168)
Cash	16.2994***	13.7065***	13.6442***
	(2.5069)	(2.4743)	(2.4792)
ROA	5.5464**	5.3414**	5.4408**
	(2.3326)	(2.2415)	(2.2392)
Tobin's Q	4.2309	0.0815	0.0417
	(2.7439)	(2.5342)	(2.5399)
Board Size		1.2662***	1.2672***
		(0.1553)	(0.1559)
Board Independence		0.1303***	0.1291***
		(0.0279)	(0.0279)
Female Directors		0.2723***	0.2715***
		(0.0309)	(0.0310)
Board Busyness		12.8027***	12.7740***
		(1.8605)	(1.8606)
Ln CEO Age			-1.1101
			(2.6353)
Ln CEO Tenure			-0.1070
			(0.2277)
CEO Duality			0.2180
			(0.6417)
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	19,139	19,139	19,139
Adjusted R-squared	0.427	0.460	0.460

Table 3: CEO turnover events

This table reports regression results considering CEO changes from outsider to insider (Panel A) and insider to outsider (Panel B). In Panel A, *Outsider to Insider1* (*Outsider to Insider2*) [*Outsider to Insider3*] is a dummy variable set to 1 for firm-year observations that are one-year (two-year) [three-year] before the CEO turnover year in which an outsider CEO was in office and 0 for the same period after an insider CEO takes over the office. In Panel B, *Insider to Outsider1* (*Insider to Outsider2*) [*Insider to Outsider3*] is a dummy variable set to 1 for firm-year observations that are one-year (two-year) [three-year] before the CEO turnover year in which an insider CEO was in office and 0 for the same period after an outsider CEO takes over the office. In defining these variables, we ensured the same CEO was in the office for the specified period. All other variables are defined in Appendix A. Heteroscedasticity-robust standard errors are in parentheses, clustered by firm. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Panel A: CEO turnover from an outsider to an insider

	(1)	(2)	(3)
	Env Score	Env Score	Env Score
Outsider to Insider CEO1	0.8641		
	(1.1932)		
Outsider to Insider CEO2		4.4926***	
		(1.3432)	
Outsider to Insider CEO3			5.0604***
			(1.5865)
Ln Assets	6.7835***	5.9857***	6.4164***
	(0.7305)	(0.7016)	(0.7099)
Leverage	1.6668	-7.4931	-7.9493*
	(5.0287)	(4.7232)	(4.7881)
R&D Intensity	-0.6979*	0.1945	0.3112
	(0.3668)	(0.3565)	(0.3430)
Cash	7.5146	8.1234*	9.3286*
	(4.6786)	(4.5658)	(4.7882)
ROA	-3.0925	3.8262	6.9127
	(4.7540)	(4.3282)	(4.5371)
Tobin's Q	-8.6249*	0.6359	0.1271
	(4.5853)	(4.3893)	(4.5939)
Board Size	1.0761**	1.0987***	1.1590***
	(0.4173)	(0.3726)	(0.3695)
Board Independence	0.1792***	0.1076**	0.0756
	(0.0562)	(0.0467)	(0.0514)
Female Directors	0.1761***	0.1301**	0.1362**
	(0.0679)	(0.0655)	(0.0680)
Board Busyness	1.1635	7.4219*	3.6442
	(4.5824)	(4.0820)	(4.1759)
Ln CEO Age	-3.1134	-2.1640	-5.8025
	(6.1627)	(5.8821)	(6.0845)
Ln CEO Tenure	-0.5045	-1.7462**	-1.2541*
	(0.9044)	(0.7890)	(0.6872)
CEO Duality	0.2918	0.4459	-0.2269
	(1.5169)	(1.4361)	(1.4473)
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	858	1,027	1,084
Adjusted R-squared	0.404	0.442	0.435

Panel B: CEO turnover from an insider to an outsider

	(1)	(2)	(3)
	Env Score	Env Score	Env Score
Insider to Outsider CEO1	-4.1023		
	(2.7441)		
Insider to Outsider CEO2		-2.2653	
		(1.9226)	
Insider to Outsider CEO3			-1.5503
			(2.3591)
Ln Assets	10.6863***	12.0755***	11.2242***
	(1.1576)	(1.1736)	(1.2022)
Leverage	-8.0053	-7.6082	-12.5675
	(8.4655)	(8.2662)	(8.7609)
R&D Intensity	2.2918*	0.1189	1.7516
	(1.3850)	(0.7658)	(1.3932)
Cash	11.0484	25.2648***	21.8682***
	(8.7601)	(7.6145)	(8.1181)
ROA	1.6899	-3.1358	9.5672
	(8.1088)	(6.9731)	(8.3582)
Tobin's Q	4.1354	-6.3039	-4.6766
	(7.7435)	(7.6707)	(8.0526)
Board Size	0.7391	0.7492	0.8589
	(0.7176)	(0.5759)	(0.5746)
Board Independence	0.2358***	0.1835*	0.0745
	(0.0905)	(0.0935)	(0.0974)
Female Directors	0.2746**	0.2260*	0.3131**
	(0.1140)	(0.1241)	(0.1221)
Board Busyness	0.0777	2.2473	6.3313
	(6.4513)	(6.9209)	(7.0397)
Ln CEO Age	-15.5580	-14.7690	-11.8517
	(10.3178)	(9.2352)	(10.6236)
Ln CEO Tenure	2.0193	1.7792**	1.4606**
	(1.2856)	(0.7162)	(0.7365)
CEO Duality	1.5823	-1.1923	-0.8938
	(3.2792)	(2.2489)	(2.3737)
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	464	632	653
Adjusted R-squared	0.443	0.465	0.448

Table 4: R&D channel

This table reports regression results on the association between CEO origin and firm innovation activities, proxied by investment in R&D (Column 1), and the moderating effect of innovative activities on the association between CEO origin and firm environmental performance (Column 2). *High R&D* is a dummy variable set to 1 if the firm's investment in R&D (scaled by sales) in a year is greater than the industry median and 0 otherwise. *Insider CEO* is a dummy variable set to 1 if the CEO had worked for two years or more in the same firm before becoming the CEO and 0 otherwise. All other variables are defined in Appendix A. Heteroscedasticity-robust standard errors are in parentheses, clustered by firm. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)
	High R&D	Env Score
Insider CEO	0.1783*	1.9350**
	(0.0931)	(0.7674)
High R&D		3.2537***
		(1.2109)
Insider CEO*High R&D		3.0682**
		(1.2192)
Ln Assets	-0.1188***	8.3084***
	(0.0459)	(0.3335)
Leverage	-1.2817***	-5.3653*
	(0.4016)	(2.8143)
Cash	3.7869***	10.7948***
	(0.3936)	(2.4942)
ROA	-1.8491***	4.4180*
	(0.2935)	(2.2547)
Tobin's Q	-0.0980	-0.2300
	(0.3580)	(2.6843)
Board Size	0.0330	1.2622***
	(0.0265)	(0.1633)
Board Independence	0.0146***	0.1313***
	(0.0043)	(0.0289)
Female Directors	0.0137***	0.2506***
	(0.0046)	(0.0326)
Board Busyness	1.1226***	11.1230***
	(0.2583)	(1.9999)
Ln CEO Age	-0.9075**	-1.5961
	(0.4304)	(2.7988)
Ln CEO Tenure	0.0447	-0.1125
	(0.0338)	(0.2446)
CEO Duality	-0.0303	0.1799
	(0.0935)	(0.6671)
Industry FE	Yes	Yes
Year FE	Yes	Yes
Observations	16,106	16,106
Log pseudolikelihood	-7332.398	--
Adjusted R-squared	--	0.479

Table 5: Alternative Explanation

This table reports regression results on the effect of prior year firm performance on the association between CEO origin and environmental performance. *High ROA Past 2Y* (*High ROA Past 3Y*) is a dummy variable set to 1 if the firm's ROA in the past two (three) years was higher than the industry median and 0 otherwise. *Insider CEO* is a dummy variable set to 1 if the CEO had worked for two years or more in the same firm before becoming the CEO and 0 otherwise. All other variables are defined in Appendix A. Heteroscedasticity-robust standard errors are in parentheses, clustered by firm. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)
	Env Score	Env Score
Insider CEO	2.5403***	2.7061***
	(0.6689)	(0.6590)
High ROA Past 2Y	2.4358**	
	(1.1230)	
Insider CEO*High ROA Past 2Y	0.4521	
	(1.1467)	
High ROA Past 3Y		2.4255**
		(1.1650)
Insider CEO*High ROA Past 3Y		0.2183
		(1.1795)
Ln Assets	8.2940***	8.2887***
	(0.3116)	(0.3118)
Leverage	-6.8174***	-6.8432***
	(2.5748)	(2.5794)
R&D Intensity	0.6769**	0.6899**
	(0.3092)	(0.3101)
Cash	13.0456***	13.0763***
	(2.4574)	(2.4609)
ROA	1.0390	1.7204
	(2.0257)	(2.0408)
Tobin's Q	1.0099	0.8036
	(2.5280)	(2.5300)
Board Size	1.2498***	1.2546***
	(0.1557)	(0.1559)
Board Independence	0.1287***	0.1299***
	(0.0278)	(0.0278)
Female Directors	0.2633***	0.2649***
	(0.0309)	(0.0310)
Board Busyness	12.9583***	12.9626***
	(1.8491)	(1.8508)
Ln CEO Age	-1.3128	-1.2647
	(2.6252)	(2.6265)
Ln CEO Tenure	-0.1023	-0.1012
	(0.2276)	(0.2278)
CEO Duality	0.1658	0.1621
	(0.6391)	(0.6399)
Industry FE	Yes	Yes
Year FE	Yes	Yes
Observations	19,139	19,139
Adjusted R-squared	0.463	0.462

Table 6: Firm value

This table reports regression results on the interaction effect of CEO origin and environmental performance on a firm's financial- and market performance. *High Env Score* is a dummy variable set to 1 if the firm's *Env Score* in a year is higher than the industry median and 0 otherwise. *Insider CEO* is a dummy variable set to 1 if the CEO had worked for two years or more in the same firm before becoming the CEO and 0 otherwise. All other variables are defined in Appendix A. Heteroscedasticity-robust standard errors are in parentheses, clustered by firm. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	ROA	Tobin's Q	Stock Returns	MB
Insider CEO	0.0169***	-0.0183**	-0.0197	0.0003
	(0.0062)	(0.0085)	(0.0236)	(0.0002)
High Env Score	0.0175**	-0.0121	-0.0317	-0.0004
	(0.0078)	(0.0123)	(0.0300)	(0.0003)
Insider CEO*High Env Score	-0.0032	0.0085	0.0323	0.0008***
	(0.0078)	(0.0117)	(0.0306)	(0.0003)
Ln Assets	0.0035***	0.0222***	-0.0151***	-0.0004***
	(0.0013)	(0.0029)	(0.0031)	(0.0001)
Leverage	-0.0632***	0.6153***	-0.0249	0.0042***
	(0.0078)	(0.0184)	(0.0218)	(0.0005)
R&D Intensity	-0.0472***	0.0033	-0.0087	0.0002***
	(0.0027)	(0.0027)	(0.0067)	(0.0001)
Capex	-0.0142***	-0.0317***	-0.0212	-0.0007***
	(0.0046)	(0.0082)	(0.0167)	(0.0002)
SD3ROA	-0.2402***	-0.0165	0.3534***	0.0036***
	(0.0338)	(0.0342)	(0.0841)	(0.0009)
Board Size	-0.0005	0.0039***	-0.0023	0.0001***
	(0.0006)	(0.0013)	(0.0016)	(0.0000)
Board Independence	-0.0002	0.0010***	0.0001	0.0000**
	(0.0001)	(0.0002)	(0.0003)	(0.0000)
Female Directors	0.0003**	0.0006**	-0.0004	0.0000***
	(0.0001)	(0.0002)	(0.0003)	(0.0000)
Board Busyness	-0.0207***	0.0186	0.0218	0.0015***
	(0.0073)	(0.0137)	(0.0202)	(0.0004)
Inst. Ownership	0.0001	-0.0006***	0.0004*	0.0000
	(0.0001)	(0.0001)	(0.0002)	(0.0000)
Ln CEO Age	0.0255**	-0.0426**	-0.1050***	-0.0014**
	(0.0120)	(0.0213)	(0.0324)	(0.0006)
Ln CEO Tenure	0.0020**	-0.0009	0.0048	0.0000
	(0.0009)	(0.0017)	(0.0029)	(0.0000)
CEO Duality	0.0005	0.0153***	0.0116*	0.0003**
	(0.0023)	(0.0047)	(0.0064)	(0.0001)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	16,521	16,521	16,530	16,521
Adjusted R-squared	0.351	0.602	0.304	0.146

Table 7: Robustness tests

This table reports robustness test results on the association between CEO origin and firm environmental performance in which we apply a propensity score matching (Column 1), environmental performance score from KLD (Column 2), and include CEO fixed effects (Column 3) in the baseline regression. All variables are defined in Appendix A. Heteroscedasticity-robust standard errors are in parentheses, clustered by firm. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)
	Env Score	Env Score	Env Score
Insider CEO	3.3773***	0.0493**	1.1571**
	(0.8152)	(0.0239)	(0.4951)
Ln Assets	7.1311***	0.1268***	4.5391***
	(0.4878)	(0.0117)	(0.4767)
Leverage	-9.8088***	0.1593**	-4.3545*
	(3.3529)	(0.0730)	(2.2606)
R&D Intensity	0.4270	0.0230**	0.4593***
	(0.3482)	(0.0099)	(0.1694)
Cash	9.8335***	0.3161***	4.1402***
	(3.5077)	(0.0821)	(1.5992)
ROA	0.2121	0.4072***	1.6654
	(3.2708)	(0.0920)	(1.3385)
Tobin's Q	4.9463	-0.1225	1.5001
	(3.1238)	(0.0813)	(2.1012)
Board Size	1.4846***	0.0145***	0.3715***
	(0.2511)	(0.0052)	(0.1207)
Board Independence	0.1645***	0.0017**	0.0161
	(0.0362)	(0.0009)	(0.0245)
Female Directors	0.1644***	0.0055***	0.1729***
	(0.0442)	(0.0011)	(0.0233)
Board Busyness	5.7900**	0.1494**	0.6656
	(2.8451)	(0.0630)	(1.3330)
Ln CEO Age	-0.9193	-0.0605	36.1453
	(3.6169)	(0.0832)	(24.0894)
Ln CEO Tenure	-1.5020***	-0.0077	0.1000
	(0.5462)	(0.0079)	(0.1686)
CEO Duality	0.6488	0.0179	-0.9695*
	(1.0365)	(0.0213)	(0.5762)
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
CEO FE	No	No	Yes
Observations	2,370	14,614	19,139
Adjusted R-squared	0.433	0.197	0.822