Borderless Leadership for a Sustainable Future:
TMT Nationality Diversity and the Path to Low-Carbon Innovation

Sompassorn Ruksomboonde

May 2025

Abstract

As environmental concerns become an increasingly urgent global focus, businesses face growing pressure to reduce their carbon emissions. The Top Management Team (TMT) plays a pivotal role in shaping a firm's sustainability strategies. Despite this importance, a significant research gap remains regarding the precise impact of TMT characteristics—particularly nationality diversity—on corporate carbon emissions. This study investigates the relationship using a global dataset of 4,610 public firms across 52 countries from 2002 to 2019. Leveraging SEC diversity disclosure regulations in the U.S. and CEO deaths as exogenous shocks, our findings reveal that greater top management team (TMT) nationality diversity is associated with lower corporate carbon emissions. This relationship is driven by TMT members, particularly from countries with strong environmental standards. They promote green technology innovation and implement more sustainable governance practices, such as ESG-linked executive compensation and the formation of sustainability committees. Moreover, they enhance sustainable operational practices by promoting sustainable supply chains and effective materials management.

Keywords: Top management team nationality diversity, carbon emissions, green technology innovation, sustainable operation and sustainable corporate governance practices.

I. Introduction

Environmental concerns have become an increasingly important focus in corporate finance due to growing pressure from investors, consumers, and regulators. One of the main drivers of this pressure is carbon, or greenhouse gas (GHG) emissions, which are a major contributor to climate change (Stern, 2006). Companies incur direct costs of releasing carbon emissions from their own operations, and indirect costs from upstream and downstream activities. For instance, there is a notable decrease in the profitability and value of carbon-intensive companies compared to low-emission firms following the introduction of carbon pricing policies (Duan, Li, Zhang, 2024). This issue has heightened the demand for information from investors about how companies handle their carbon emissions. This information is crucial, as it reflects not only a company's environmental investments but also its financial performance and valuation, especially as investors increasingly incorporate such factors into their decision-making (Ben-Amar et al., 2017). Hence, environmental concerns are important in both business and academia. Increasing research has identified various corporate factors that significantly impact a firm's carbon emissions, including director characteristics (Xie and Liu, 2022), shareholder engagement (Azar, Duro, Kadach, and Ormazabal, 2021), and consumer demand (Bonini and Oppenheim, 2020).

The Top Management Team (TMT) plays a crucial role in shaping an organization's success and reputation. Their decisions and behaviors reflect the organization's core values, priorities, and strategic direction (Ma, Kor, & Seidl, 2021). According to upper-echelon theory, the attributes of top managers significantly influence their perceptions, choices, and strategic decisions, which in turn affect the overall performance and trajectory of the organization (Hambrick & Mason, 1984). As globalization has progressed, firms have increasingly sought leadership talent from a broader international pool, enhancing the nationality diversity of their TMTs. While this nationality diversity may bring broader perspectives, global awareness, and cultural sensitivity that support sustainable operation, it may also introduce coordination challenges or conflicting values that hinder unified action on carbon reduction. These two contrasting views underscore the importance of our main research question: how does TMT nationality diversity influence corporate carbon emissions?

One possible view is that increasing TMT nationality diversity may bring specialized knowledge, broader perspectives, and global awareness on sustainable operation by including TMT members with advanced environmental knowledge and expertise from high environmental standard countries. This view is supported by the cognitive diversity hypothesis, which suggests that diverse teams can foster innovation and more effective problem-solving, a key for tackling complex issues like carbon emissions. They are more likely to consider alternative perspectives on environmental risks and solutions. The knowledge-based view also supports this possible view because the firm can utilize the specialized knowledge of its members to gain a competitive advantage (Grant, R. M., 1996). However, these benefits may be offset by challenges such as communication barriers, conflicting values, and slower decision-making, which can reduce strategic alignment and increase volatility (Kang, Kim, & Oh, 2022). TMT nationality diversity may introduce variability in decision-making processes and create difficulties in reconciling different preferences, which can impact on the overall effectiveness of firm direction. Homogeneous TMTs may operate more cohesively, avoid internal conflicts, and more effectively pursue sustainability goals (Greve, Biemann, & Ruigrok, 2015; Ruigrok & Georgakakis, 2013). Therefore, while TMT nationality diversity presents both opportunities and risks, its net impact on corporate carbon emissions remains uncertain—an important issue this study seeks to explore.

As mentioned earlier, TMT members from countries with well-developed environmental standards may be a key channel through which TMT nationality diversity contributes to sustainable operations. These members can bring valuable insights and drive green technology innovation. This includes developing and implementing technologies that reduce environmental impact, enhance resource efficiency, and promote long-term ecological sustainability. Effectively addressing environmental challenges often depends on advancements in green technology (Sachs et al., 2019; Scherer & Voegtlin, 2020). Numerous studies support the link between green technology innovation and improved sustainability outcomes. Evidence spans various contexts, including Chinese manufacturing firms (Liao & Zhang, 2020), Japanese manufacturers between 2001 and 2010 (Lee & Min, 2015), small and medium-sized enterprises in the United Arab Emirates (Singh et al., 2020), Malaysian companies (Kraus et al., 2020), and manufacturing sectors in the European Union (Costantini et al., 2017). Green technology innovation offers benefits such as cost savings, risk reduction, and reputational protection, all of which support firms' broader sustainability objectives (Dangelico & Pujari, 2010).

Our paper offers an important insight into the ongoing debate by examining the impact of TMT nationality diversity on corporate carbon emissions and identifying the specialized knowledge on green technology innovation, brought by diverse TMT members, as a key channel through which this impact occurs. While previous studies have examined the impact of TMT nationality diversity on sustainability, our research distinguishes by using an international dataset to enhance the generalizability of our findings. Unlike studies that focus on specific samples in a few countries or rely solely on cross-sectional survey methods, we adopt textual analysis to identify TMT around the world which incorporates both time series and cross-sectional data. Moreover, we identify green technology innovation as a new channel through which TMT diversity can add value to the firm, contributing deeper insights to the existing literature on green technology innovation. To the best of our knowledge, this paper is the first paper that directly tests the impact of TMT nationality diversity on corporate carbon emissions using international evidence.

We conduct a comprehensive analysis covering international samples of 4,610 public firms from 52 countries between 2002 and 2019 to examine the impact of TMT nationality diversity on corporate carbon emissions. We use textual analysis to classify TMT positions that cover C-level and two levels below C-level (Fox et al., 2022; Hambrick and Chen,1996) and calculate firm-level TMT nationality diversity. Our investigation uses linear regression with fixed effects to explore the baseline relationship between TMT nationality diversity and corporate carbon emission. Our research uncovers significant evidence indicating that TMT nationality diversity helps lower corporate carbon emissions on a global scale. This finding suggests that firms with the TMT comprising individuals from diverse nationality backgrounds or from foreign countries tend to prioritize environmental concerns. In economic terms, increasing nationality diversity by one standard deviation is associated with a 1.02% reduction in direct carbon emissions. This decrease is roughly one-third of the median annual growth rate in direct carbon emissions around the world. Thus, enhancing TMT nationality diversity has the potential to notably mitigate the pace of carbon emission increases.

The effect of TMT nationality diversity on corporate carbon emissions can introduce endogeneity issues due to several factors. Firstly, there may be self-selection biases, where TMT members may choose or be more likely to join firms that already have certain environmental values, strategies, or reputations that match their own personal beliefs or cultural background. External factors such as certain regulations or organizational cultures may simultaneously influence both TMT nationality diversity and environmental performance, exacerbating endogeneity concerns. To address this issue, we employ two identification tests. In the first test, we employ difference-in-difference method and use Regulation S-K, specifically Item 407(c)(2)(vi), issued by the Securities and Exchange Commission (SEC) in 2009, requiring the disclosure in their proxy statements whether and how the nominating committee considers diversity when identifying director nominees. This rule reflects a heightened focus on nationality diversity within the corporation, creating an exogenous shock to the nationality diversity of the top managers within the firm. To maintain a positive corporate image and visibility to the public, firms proactively encourage nationality diversity when selecting directors and top managers. We use the difference-in-differences method to compare treated firms—those in the US affected by the diversity disclosure mandate introduced in 2009—with control firms located in other countries that were unaffected by this specific requirement. This approach examines the impact of the diversity disclosure mandate by analyzing differences before and after its implementation between treat and control group. We find that following the implementation of SEC 2009, we observe a significant positive change in TMT nationality diversity and lower carbon emissions in treated firms. This may imply that this SEC's policy had a notable effect on increasing transparency and action towards improving TMT nationality diversity within treated firms. From this promotion of TMT nationality diversity, these firms were influenced to adopt practices that reduce their corporate carbon emission. Specifically, companies in the U.S. have exhibited more diverse TMTs and lower carbon emissions following the 2009 SEC disclosure mandate, compared to companies outside the U.S. Similarly, in the second identification test, we also utilize the difference-in-difference method and use CEO death to create exogenous variation in TMT nationality diversity. This sudden shock introduces a source of variation in TMT composition that is unrelated to underlying factors influencing carbon emissions, thereby helping to reduce endogeneity concerns. Following the CEO's death, we find a significant decrease in nationality diversity in the treated firms due to the replacement of foreign CEOs with local candidates. Additionally, the decrease in TMT diversity is associated with a significant increase in total carbon emissions, reflecting the shifts in environmental priorities. This suggests that changes in leadership characteristics may influence the firm's environmental operation and strategies. Both results of these identification tests are consistent, confirming the robust causal inferences and validity of our baseline findings.

Several mechanisms contribute to this observed relationship. The first possible channel is that nationally diverse TMTs include members from countries with well-developed environmental standards. We test the cross-sectional variation in corporate carbon emissions in relation to TMT nationality diversity by categorizing TMT members based on their countries of origin and corresponding Environmental Performance Index (EPI) scores. TMTs who have worked in countries with well-established sustainability initiatives are likely to offer insights and practices that can enhance their current organizations' sustainability strategies (Meng, Wang and Yu, 2022). Our results reveal that firms with a higher proportion of TMT members from countries with high EPI scores have significantly lower corporate carbon emissions. This finding supports our expectation that the effect of TMT nationality diversity on reducing carbon emissions is more pronounced for firms with TMT members originating from countries with higher environmental performance.

Secondly, those TMT members from countries with higher environmental performance draw on their specialized knowledge of sustainable operations to play a crucial role in fostering a culture of green technology innovation within the organization, significantly enhancing environmental awareness and practices. Previous literature has indicated that TMT diversity influences enterprises' strategic patenting and enhances technology innovation (Zhou, Zhang, Zhao, & Chen, 2022; Boone et al., 2019). Furthermore, foreign institutional ownership facilitates knowledge transfer from economies with high innovation activity, resulting in more green patents and initiatives addressing environmental and social issues (Luong, Moshirian, Nguyen, & Tian, 2017; Cao, Zhan, & Zhang, 2017). We use cumulative number of green patent grants, green patent applications and the proportion of green patent grants relative to the total number of green patent grants in the industry. We find that the presence of TMT nationality diversity leads to higher level of green technology innovation, which is evidenced by a notable increase in green patent applications and grants. Firms with higher TMT nationality diversity tend to exhibit a greater cumulative number of green patents, reflecting their commitment to environmental concerns. Consistently, these firms account for a higher proportion of green patent grants relative to the industry's total. Economically, a one standard deviation increase in TMT nationality diversity corresponds to a 4.06% rise in the number of accumulated green patents. This improvement underscores the positive impact of TMT nationality diversity on driving green technology innovation.

The third potential channel is that nationally diverse TMTs enhance sustainable operations with its suppliers. When it comes to promoting sustainable operations, nationally diverse TMTs can leverage their insights and networks from past global experience to collaborate with international partners to strengthen firm's sustainable operations (Li, Zhang and Ding, 2023). We use a probability model to explore this possibility, focusing on three main proxies: environmental material sourcing, environmental supply chain management, and supplier termination based on environmental criteria. Our findings align with our expectations, showing that nationally diverse TMTs foster sustainable operations through supply chain management. Economically, a one standard deviation increase in nationality diversity is associated with a 26.5% higher likelihood of engaging in environmental material sourcing and a 27% higher likelihood of terminating suppliers based on environmental criteria.

The fourth potential channel is that nationally diverse TMTs leverage their broader perspectives on the global standard of sustainability to enhance the firm's sustainable corporate governance practices. Iliev and Roth (2022) documents that a director's expertise on sustainability issues impacts the adoption of specific board policies to improve sustainable corporate governance practices. We employ a probability model to examine the impact of TMT nationality diversity on sustainable corporate governance, using proxies such as the ESG-compensation link and the presence of a sustainability committee. Our results show that firms with greater TMT nationality diversity are more likely to tie executive compensation to ESG performance metrics and have sustainability committees. This suggests that nationally diverse TMTs may offer unique insights into sustainable corporate governance practices that are prevalent or successful in their respective countries.

Our research makes several significant contributions to the fields of leadership diversity, green technology innovation and sustainable operation. Firstly, we broaden the scope of management diversity research by examining a unique aspect of TMT, rather than concentrating solely on boards of directors or CEOs. Additionally, we focus specifically on the environmental dimension by exploring the impact of TMT nationality diversity on corporate carbon emissions. While existing literature shows that TMT nationality diversity can enhance corporate social responsibility (CSR) through inter-organizational networks (Dahms, Kingkaew, and Ng, 2020), it has largely overlooked the environmental perspective. To our best knowledge, no prior studies have conclusive answers on the relationship between TMT nationality diversity and corporate carbon emissions. This environmental concern is considered one of the critical corporate risks as firms need to comply with changes in environmental-related regulations and to meet stakeholders' expectations on environmental performance.

Secondly, we explore a new channel through which a firm's TMT nationality diversity influences its corporate carbon emissions. While previous research has shown that TMT diversity can build inter-organizational networks and provide access to global information on environmental initiatives, our study uncovers additional mechanisms. We find that TMT nationality diversity brings green technology innovation, sustainable supply chain management, and improved corporate governance. Our research demonstrates that nationally diverse TMTs bring a wide range of perspectives and insights, particularly in the context of global markets and sustainable operations.

Thirdly, our study extends to international scope which allows for enhanced result comparisons across firms in various regions and provides valuable international evidence on the relationship between TMT nationality diversity and corporate carbon emissions. By analyzing worldwide data over a period of 17 years, this international perspective enhances the generalizability and robustness of our findings, contributing to a deeper understanding of the role of diversity in addressing global sustainability challenges. Overall, the anticipated outcomes hold the potential for meaningful implications for managers, investors, and policymakers. This research thereby contributes to frame a more equitable and progressive business landscape which brings forth a multi-dimensional perspective that can potentially drive positive environmental change across industry, investment, and policy arenas.

The rest of the paper is organized as follows. Section II introduces data and variables. Section III presents the main findings and identification strategies. Section IV illustrates the underlying mechanism, Section V elaborates the discussion, and Section VI concludes the paper. Variable definitions are in the Appendix.

II. Data and Variables

A. TMT Nationality Diversity

We gather TMT employment details and nationality data from BoardEx, a database encompassing over 10,000 publicly traded companies globally. BoardEx offers comprehensive senior management profiles, including their biographies and career backgrounds. By consolidating the employment histories and nationalities of managers, we categorize them into TMT and non-TMT groups. We use specific keywords to categorize managers as part of the TMT. Consistent with the approach outlined by Roberson, IV, and Perry (2022), our TMT category encompasses C-level executives and two levels below, such as Chief Executive Officer, Chief Operating Officer, other Chief Officers, President, Senior Vice-President, and Executive Vice-President. Our analysis includes only executive director (ED) and senior management (SM) positions, excluding non-executive director roles from our samples. Once we identify the TMT members and their nationalities within each company, we compute the level of national diversity at the firm level. Following the methodology proposed by An, Chen, Wu, and Zhang (2021), we calculate the proportion of distinct TMT nationalities to total TMT members. We count the unique nationalities represented among each firm's TMT members, and this count is subsequently divided by the total number of the firm's TMT members.

$$(1) \qquad \text{Nationality diversity} = \frac{\text{Number of Unique TMT Nationalities}}{\text{Total Number of TMTs}}$$

B. Corporate Carbon Emissions

We measure the corporate carbon emission levels, encompassing both direct and indirect carbon emissions, using annual data from S&P Global Trucost. This data source also includes worldwide data covering more than 16,000 firms from 2002 to 2019. We follow the Greenhouse Gas Protocol, which sets standards for measuring corporate carbon emissions and distinguishes between two sources: direct and indirect carbon emissions. Direct carbon emissions encompass those owned or controlled by the company, including emissions from fossil fuels used in production. Indirect carbon emissions arise from purchased heat, steam, and electricity generation, as well as carbon emissions from activities not owned or controlled by the company, such as the production of purchased materials, product use, waste disposal, and outsourced activities. To confirm the robustness of our findings, we also use the natural logarithm of carbon intensity as an alternative proxy. Carbon intensity is calculated as carbon emissions relative to revenue, which standardizes emissions in relation to the firm's economic performance. Taking the natural logarithm helps normalize the distribution of this variable. This approach aids in validating the consistency of our baseline results.

$$(2) \qquad \text{Carbon\_intensity\_total} = \text{Log}\left(\frac{\text{Total Carbon Emission}}{\text{Revenue}}\right)$$

C. Green Technology Innovation

We incorporate international patent data from the PatentsView database. Following previous literature related to green technology innovation, we view green patents as a good proxy for a firm's capacity to generate knowledge and develop technologies for achieving sustainable operation (Valero-Gil et al., 2023; Barbieri et al., 2020; Dechezlepretre et al., 2015; Marin, 2014; Nagaoka et al., 2010). We use the natural logarithm of cumulative number of green patent applications to indicate the extent of the attempt at green innovation and the natural logarithm of cumulative number of green patent grants to measure the quantity of green innovation (Cao et al., 2023). To account for the possible trend in an industry, we scale the number of green patent grants with an industry's aggregate number each year. Hence, the main three variables as proxies for green technology innovation are the cumulative number of firm green patent applications, green patent grants, and the proportion of firm green patent grants relative to the total number of green patent grants in the industry.

$$(3) \qquad \text{Green\_patent\_grant} = \text{Log}(\text{The cumulative number of green patent grants})$$

$$(4) \qquad \text{Green\_patent\_application} = \text{Log}(\text{The cumulative number of green patent applications})$$

$$(5) \qquad \text{\%Green\_patent\_grant to industry} = \frac{\text{The cumulative number of green patent grants}}{\text{The total cumulative number of green patent grants in the industry}}$$

D. Sustainable Operation and Supply Chain Management

We use three proxies for sustainable operations and supply chain management, each represented as a dummy variable that takes a value of either 1 or 0. First, the environmental material sourcing indicator reflects whether the firm prioritizes the use of materials with a lower ecological footprint in its operations. The other two variables, environmental supply chain management and supplier termination based on environmental criteria, indicate whether the firm applies sustainable procedures in the selection and termination of its suppliers. Data for these variables were obtained from DataStream Eikon and Bloomberg.

E. Sustainable Corporate Governance

For the sustainable corporate governance proxy, we adopt the approach outlined by Iliev and Roth (2023), using two indicators: the presence of a sustainability committee and executive compensation tied to ESG performance. Each indicator is represented as a dummy variable, equal to 1 if the firm has a sustainability committee or if executive compensation is linked to ESG performance, respectively, and 0 otherwise. We also obtained this data from DataStream Eikon and Bloomberg.

F. EPI

According to the Yale Center for Environmental Law and Policy, the Environmental Performance Index (EPI) provides a data-driven summary of the state of sustainability around the world. Using 58 performance indicators across 11 issue categories, the EPI ranks 180 countries based on their performance in climate change, environmental health, and ecosystem vitality. This indicator measures, at a national scale, how close each country is to established environmental policy targets. We use the EPI to classify firms' TMT nationality diversity into high and low EPI groups and examine the relationship between each group and carbon emission levels. This classification is based on the percentage of TMT members originating from countries ranked within the top 20 of the EPI. Firms are categorized as having high or low EPI exposure depending on whether their percentage of top-20 EPI nationalities is above or below the sample average.

$$(6)\ \text{Average EPI for the firm's TMT} = \frac{\text{Number of TMT members originating from top 20 EPI countries}}{\text{Total Number of TMTs}}$$

G. Firm Characteristics

We obtain firm accounting and fundamental data from Compustat and DataStream Eikon. We use the following firm characteristics as control variables: firm size is measured as the natural logarithm of total assets, denoted by Log_asset. Leverage (Lev) is calculated as the sum of long-term debt and current liabilities scaled by total assets. Return on assets (ROA) is the operating income ratio before depreciation scaled by total assets. The book-to-market ratio is the natural logarithm of the book value of equity over the market value of equity, denoted by Log_BM. Fixed asset ratios (PPE) are defined as the ratio of total property, plant, and equipment to total assets. Definitions of these variables are presented in the Appendix.

H. Summary Statistics

After combining the dataset of TMT nationality diversity, corporate carbon emissions, and firm characteristics for baseline analysis, our final sample consists of 29,488 firm-year observations encompassing 4,610 distinct firms from 2002 to 2019.

Table 1 presents summary statistics. Panel A shows the statistics of TMT nationality diversity. The mean (median) of the TMT nationality diversity is 0.444 (0.500), and the standard deviation is 0.228. Panel B presents corporate carbon emissions with direct and indirect carbon emissions and carbon intensity subcategories. Panels C, D, F and G present summary statistics for green technology innovation, sustainable operation and supply chain management, sustainable corporate governance, and firm characteristics, respectively.

Table 1
Summary Statistics

Table 1 reports the summary statistics of TMT Nationality Diversity (Panel A), Corporate Carbon Emissions (Panel B), Green Technology Innovation (Panel C), Sustainable Operation and Supply Chain Management (Panel D), Sustainable Corporate Governance (Panel E), EPI (Panel F), and Firm Characteristics (Panel G) covering mean, standard deviation, 1st percentile, 25th percentile, median, 75th percentile, and 99th percentile.

VARIABLES	Mean	Std.Dev	P1	P25	Median	P75	P99
Panel A. TMT Nationality Diversity							
Nationality diversity	0.444	0.228	0.034	0.250	0.500	0.500	1.0
Panel B. Corporate Carbon Emissions							
Log_carbon_direct	4.477	1.181	1.764	3.706	4.454	5.242	7.304
Log_carbon_indirect	5.508	0.930	3.218	4.900	5.542	6.152	7.522
Log_carbon_total	5.590	0.958	3.282	4.956	5.620	6.249	7.684
Carbon_intensity_direct	2.433	1.935	-1.8325	1.257	2.575	3.455	6.695
Carbon_intensity_indirect	4.805	0.926	3.176	4.071	4.799	5.526	6.737
Carbon_intensity_total	4.995	1.035	3.222	4.172	4.972	5.783	7.125
Panel C. Green Technology Innovation							
Green_patent_grant	28.300	204.630	0	0	0	1	724
Green_patent_application	44.330	278.270	0	0	0	3	1,036
%Green_patent_grant to industry	0.003	0.020	0	0	0	0.00004	0.076
Panel D. Sustainable Operation and Supply Chain Management							
Environmental material sourcing	0.331	0.470	0	0	0	1	1
Environmental supply chain management	0.453	0.497	0	0	0	1	1
Supplier termination based on environmental criteria	0.156	0.363	0	0	0	0	1
Panel E. Sustainable Corporate Governance							
ESG-linked compensation	0.202	0.401	0	0	0	0	1
Sustainability committee	0.131	0.338	0	0	0	0	1
Panel F. EPI							
Average EPI for the firm's TMT	55.270	12.365	18.9	51.1	51.1	62.5	77.7
Panel G. Firm Characteristics							
Log_asset	6.736	0.826	4.946	6.193	6.688	7.244	8.943
Log_BM	-0.366	0.369	-1.452	0.571	-0.336	0.121	0.398
PPE	0.244	0.248	0.001	0.250	0.158	0.358	0.943
Lev	0.370	0.264	0.000	0.000	0.365	0.532	0.924
ROA	0.056	0.110	-0.327	0.827	0.053	0.094	0.326

III. The Role of TMT Nationality Diversity in Driving Emission Reductions

We use the following regression to examine the relationship between TMT nationality diversity and corporate carbon emissions.

(7) $\text{Carbon emission}_{i,t} = \beta_0 + \beta_1\text{Nationality diversity}_{i,t} + \sum_{k=2}^{n} \beta_k(\text{Control})_{i,t} + \text{FE} + \varepsilon_{i,t}$

The dependent variables in equation (1) are carbon emission levels of firm i at year t, represented by the natural logarithm of the total carbon emission level (Log_total_carbon), direct carbon emission level (Log_direct_carbon), and indirect carbon emission level (Log_indirect_carbon). On the right side of the equation, the main variable of interest is Nationality diversity, which denotes the TMT nationality diversity level of firm i at year t. To address potential truncation bias, we include both year and firm fixed effects. Robust standard errors at the firm level are employed in all regressions.

Table 2 presents the baseline regression results organized into three sets of columns. Column 1 to 3 incorporate firm and year fixed effects, while columns 4 to 6 introduce an interaction term between industry and year fixed effects. Column 7 to 9 further include country fixed effects. In panel A, across all nine columns, the estimated coefficient of nationality diversity consistently appears significantly negative. In terms of statistical significance, TMT nationality diversity is significantly negatively associated with carbon emissions at the 1% level, as indicated by t-statistics exceeding 2.8 in Columns 1, 4, and 7. This significance persists even with the inclusion of the full set of control variables and fixed effects for year, firm, industry, and country. Notably, this relationship holds true for both direct and indirect carbon emissions. In terms of economic significance, a one standard deviation improvement in nationality diversity leads to a decrease in direct carbon emissions by 1.02%. This reduction represents approximately one-third of the median recent annual growth rate of worldwide direct carbon emissions of 3.34% (Bolton and Kaspersky's, 2021). Similarly, in Panel B, using an alternative proxy—carbon intensity—the results are consistent with those in Panel A, showing a significantly negative relationship with total carbon intensity at the 1% level (indicated by t-statistics exceeding 2.9) in Columns 1, 4, and 7. In terms of economic significance, a one standard-deviation improvement in nationality diversity leads to a decrease in total carbon intensity and direct carbon intensity by 0.95% and 1.64%, respectively. Overall, this suggests that initiatives aimed at enhancing TMT nationality diversity could serve as one mechanism for mitigating carbon emissions and advancing sustainability operations within organizations.

Among firm characteristics, we find that carbon emissions are negatively related to leverage and the book value of equity to market value of equity in line with Carradori et al., 2023, but positively related to firm size, fixed assets, and profitability (ROA), consistent with prior studies (e.g., Dinniyah and Nuzula, 2018).

Table 2

Baseline Regression: The Role of TMT Nationality Diversity in Driving Emission Reductions

Table 2 reports the baseline regression results in equation (1). In Panel A, the dependent variables are corporate carbon emission levels (total carbon emission, direct carbon emission, and indirect carbon emission) measured by Log_carbon_total, Log_carbon_direct, and Log_carbon_indirect, respectively. The main variable of interest is nationality diversity, representing the proportion of distinct TMT nationalities scaled by TMT size. In Panel B, we use another proxy for the dependent variable, corporate carbon intensity (total carbon intensity, direct carbon intensity, and indirect carbon intensity), measured by Carbon_intensity_total, Carbon_intensity_direct, and Carbon_intensity_indirect. The t-statistics (in parentheses) are based on firm-level robust standard errors. The table also presents the number of observations and R^2 values for each regression. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Details of each variable are defined in the Appendix.

Panel A

VARIABLES	(1) Log_carbon_ total	(2) Log_carbon_ direct	(3) Log_carbon_ indirect	(4) Log_carbon_ total	(5) Log_carbon_ direct	(6) Log_carbon_ indirect	(7) Log_carbon_ total	(8) Log_carbon_ direct	(9) Log_carbon_ indirect
Nationality Diversity	**-0.0290*** **	**-0.0445** **	**-0.0249** **	**-0.0288*** **	**-0.0428** **	**-0.0245*** **	**-0.0272*** **	**-0.0422** **	**-0.0229** **
	(-2.938)	(-2.060)	(-2.567)	(-3.040)	(-2.008)	(-2.638)	(-2.895)	(-1.973)	(-2.491)
Log_asset	0.748***	0.644***	0.754***	0.748***	0.661***	0.752***	0.747***	0.660***	0.752***
	(37.59)	(21.05)	(37.37)	(36.96)	(21.23)	(36.82)	(37.27)	(21.22)	(37.11)
Log_BM	-0.0650***	-0.0504***	-0.0726***	-0.0711***	-0.0640***	-0.0754***	-0.0697***	-0.0638***	-0.0740***
	(-6.354)	(-2.914)	(-7.065)	(-6.810)	(-3.631)	(-7.193)	(-6.742)	(-3.619)	(-7.131)
PPE	0.129***	0.197***	0.112**	0.157***	0.189**	0.148***	0.156***	0.189**	0.147***
	(2.792)	(2.683)	(2.355)	(3.415)	(2.519)	(3.157)	(3.495)	(2.532)	(3.241)
Lev	-0.0184*	-0.0327**	-0.0197*	-0.0257**	-0.0259	-0.0266***	-0.0243**	-0.0236	-0.0252**
	(-1.662)	(-1.991)	(-1.779)	(-2.542)	(-1.573)	(-2.641)	(-2.409)	(-1.424)	(-2.504)
ROA	0.236***	0.209***	0.249***	0.216***	0.215***	0.224***	0.211***	0.210***	0.219***
	(6.883)	(4.263)	(7.269)	(6.424)	(4.398)	(6.717)	(6.294)	(4.302)	(6.606)
Constant	0.636***	0.271	0.517***	0.507***	-0.0205	0.393***	0.512***	-0.0157	0.397***
	(4.869)	(1.341)	(3.899)	(3.631)	(-0.0955)	(2.780)	(3.687)	(-0.0731)	(2.827)
Observations	29,488	29,488	29,488	28,676	28,676	28,676	28,673	28,673	28,673
R-squared	0.475	0.121	0.486	0.983	0.954	0.982	0.983	0.954	0.983
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	NO	NO	NO	NO	NO	NO
Industry*Time FE	NO	NO	NO	YES	YES	YES	YES	YES	YES
Country FE	NO	NO	NO	NO	NO	NO	YES	YES	YES
Number of firms	4,610	4,610	4,610	4,610	4,610	4,610	4,610	4,610	4,610

Table 2

Baseline Regression: Carbon Intensity

Table 2 reports the baseline regression results in equation (1). In Panel A, the dependent variables are corporate carbon emission levels (total carbon emission, direct carbon emission, and indirect carbon emission) measured by Log_carbon_total, Log_carbon_direct, and Log_carbon_indirect, respectively. The main variable of interest is nationality diversity, representing the proportion of distinct TMT nationalities scaled by TMT size. In Panel B, we use another proxy for the dependent variable, corporate carbon intensity (total carbon intensity, direct carbon intensity, and indirect carbon intensity), measured by Carbon_intensity_total, Carbon_intensity_direct, and Carbon_intensity_indirect. The t-statistics (in parentheses) are based on firm-level robust standard errors. The table also presents the number of observations and R^2 values for each regression. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Details of each variable are defined in the Appendix.

Panel B

VARIABLES	(1) Carbon_ intensity_ total	(2) Carbon_ intensity_ direct	(3) Carbon_ intensity_ indirect	(4) Carbon_ intensity_ total	(5) Carbon_ intensity_ direct	(6) Carbon_ intensity_ indirect	(7) Carbon_ intensity_ total	(8) Carbon_ intensity_ direct	(9) Carbon_ intensity_ indirect
Nationality Diversity	**-0.0417*****	**-0.0723**	**-0.0322****	**-0.0426*****	**-0.0703**	**-0.0329****	**-0.0426*****	**-0.0703**	**-0.0329*****
	(-2.883)	(-1.493)	(-2.464)	(-2.972)	(-1.489)	(-2.590)	(-3.914)	(-1.357)	(-2.849)
Log_asset	-0.0386**	-0.273***	-0.0241	-0.0196	-0.216***	-0.00899	-0.0196	-0.216***	-0.00899
	(-2.203)	(-4.536)	(-1.422)	(-1.200)	(-3.620)	(-0.554)	(-0.910)	(-3.697)	(-0.376)
Log_BM	0.0329***	0.0675**	0.0153	0.00981	0.0266	-0.000224	0.00981	0.0266	-0.000224
	(3.012)	(1.962)	(1.487)	(0.913)	(0.740)	(-0.0221)	(1.017)	(0.659)	(-0.0221)
PPE	-0.00915	0.154	-0.0467	-0.0197	0.0616	-0.0411	-0.0197	0.0616	-0.0411
	(-0.189)	(1.077)	(-1.000)	(-0.385)	(0.399)	(-0.930)	(-0.617)	(0.592)	(-1.234)
Lev	0.0243**	-0.00798	0.0215**	0.0150*	0.0155	0.0130	0.0150	0.0155	0.0130
	(2.327)	(-0.236)	(2.235)	(1.691)	(0.519)	(1.502)	(0.979)	(0.251)	(0.993)
ROA	-0.0368*	-0.103	-0.00644	-0.0376*	-0.0450	-0.0190	-0.0376***	-0.0450	-0.0190
	(-1.773)	(-1.215)	(-0.329)	(-1.776)	(-0.526)	(-0.908)	(-2.846)	(-0.846)	(-0.953)
Constant	5.686***	4.817***	5.412***	5.151***	3.911***	4.887***	5.151***	3.911***	4.887***
	(49.97)	(12.07)	(49.72)	(45.85)	(9.437)	(44.26)	(35.87)	(9.662)	(31.43)
Observations	29,480	29,480	29,480	28,668	28,668	28,668	28,668	28,668	28,668
R-squared	0.288	0.133	0.324	0.975	0.925	0.974	0.975	0.925	0.974
Number of firms	4,610	4,610	4,610	3,798	3,798	3,798	3,798	3,798	3,798
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	NO	NO	NO	NO	NO	NO
Industry*Time FE	NO	NO	NO	YES	YES	YES	YES	YES	YES
Country FE	NO	NO	NO	NO	NO	NO	YES	YES	YES

Identification Strategy

The observed negative relationship between TMT nationality diversity and corporate carbon emissions may be subject to endogeneity concerns. For example, there may be self-selection bias, whereby TMT members are more likely to join firms that already align with their own environmental values, strategies, or cultural backgrounds or carbon emissions may decrease due to other factors correlated with nationality diversity, such as ESG regulations that cover both social equality and carbon reduction, which could affect both variables simultaneously. Additionally, companies that are more proactive in reducing their carbon footprint might also prioritize diversity in their TMT. This bias can create the appearance that diversity causes lower carbon emissions, when in fact both outcomes are independently driven by the firm's proactive management practices. We also face sample selection bias, as our study might inadvertently focus on firms that are already environmentally conscious or diverse, potentially biasing the findings. In this subsection, we employ two exogenous shocks in a difference-in-differences test and one instrumental variable test to strengthen the causal effect of TMT nationality diversity on corporate carbon emissions.

I. Evidence from Diversity Disclosure Requirement, Regulation S-K in 2009[1/]

Regulation S-K, implemented by the US Securities and Exchange Commission (SEC) in 2009, requires all public US firms to disclose director diversity. This regulation serves as an exogenous shock, introducing variation in TMT nationality diversity. It mandates directors to disclose in their proxy statements whether and how the nominating committee considers diversity in identifying director nominees, emphasizing demographic diversity as a crucial aspect of deirector quality and effectiveness. Several studies, including the latest by Kang, Kim, and Oh (2022), have utilized this diversity disclosure regulation. While this regulation does not directly enforce TMT diversity but rather requires disclosure, this disclosure requirement can directly increase TMT nationality diversity because firms may feel pressured to enhance TMT diversity to maintain a positive corporate image and visibility to the public and stakeholders. These disclosures play a critical role in enhancing transparency and accountability to shareholders, while also providing benefits to other stakeholders such as employees, customers, and communities. Stakeholders utilize diversity disclosures to make informed choices regarding employment opportunities, purchasing decisions, and assessments of corporate values. Therefore, the diversity disclosure requirement can serve as an instrumental tool for diversifying corporate boardrooms and other organizational levels (Adediran, 2023). In addition, although this regulation directly requires disclosure on the board of directors rather

[1/] The Securities and Exchange Commission (SEC) issued Regulation S-K (Item 407(c)(2)(vi)) in 2009, requiring the disclosure of directors' experience and firms' consideration of director diversity on their boards in the US. This regulation emphasizes demographic diversity as a key feature of board quality and effectiveness (Jun-Koo Kang, Seil Kim, 2022).

than TMT, it still influences TMT diversity. Some studies, such as Gould et al. (2018), suggest a 'trickle-down' effect where increasing diversity at the board level can lead to spillover effects, ultimately impacting diversity across the entire organization. This phenomenon is supported by similarity-attraction theory in psychology (Berscheid and Hatfield-Walster, 1969), which explains that people tend to associate and build relationships with others who share similar attributes, values, and characteristics. This perceived similarity fosters trust and strengthens social bonds (McPherson et al., 2001). Furthermore, the alignment between TMT diversity and board diversity requirements may facilitate the development of a talent pipeline for future CEO and board appointments (Pallab Kumar Biswas et al., 2021). Thus, while the regulation primarily targets board diversity disclosure, its effects can extend beyond the boardroom to influence broader organizational diversity initiatives.

To analyze the impact, we employ a propensity score matching approach to select control firms that closely match each treated firm based on firm characteristics from the year before the regulation's introduction. We estimate the effect of TMT nationality diversity first and subsequently its impact on carbon emission levels using difference-in-differences method. Our analysis focuses on years after 2008, as 2009 is marked as the initial year of the SEC's diversity disclosure requirement. Treated firms are US companies which were affected by the diversity disclosure mandate in 2009, while control firms are companies located in other countries which were unaffected by this specific requirement. Each treated firm is matched with a control firm from the same year based on six firm characteristics: nationality diversity, return on assets (ROA), leverage, size, book-to-market ratio (B/M), and property, plant, and equipment (PPE) ratio. Panel A of Table 3 demonstrates the quality of our matching process, showing that treated and control firms are similar before the diversity disclosure requirement. For example, the average TMT nationality diversity is 0.293 for the treated firms and 0.298 for the control firms. The differences are indistinguishable from zero. Also, the firm size, leverage, fixed assets, and profitability are consistently indistinguishable from zero. We examine the effect of TMT nationality diversity and carbon emissions in Panel B of Table 3. We limit the window to 3 years before and 3 years after the diversity disclosure shock, with the event year included. To test the effect of diversity disclosure requirement in the US, we run the following regression.

$$(8) \qquad Y_{i,t} = \alpha + \beta_1 \text{Treat}_i \times \text{Post}_{i,t} + \sum_{k=2}^{n} \beta_k (\text{Control})_{i,t} + FE + \varepsilon_{i,t}$$

where $Y_{i,t}$ represents a generic variable for Nationality diversity, Log_carbon_total, Log_carbon_direct, and Log_carbon_indirect. Treat_i is equal to one for the treated firms and zero for the matched control group. $\text{Post}_{i,t}$ is equal to one for the period following 2008 and zero otherwise. The coefficients of the interaction terms (β_1) capture changes in the differences between the treated and control groups for the TMT nationality diversity and carbon emission measures around the event time.

Panel B in Table 3 reports the difference-in-differences regression results. β_1 is significant at 5% level with the coefficient of 0.01995, suggesting that after the SEC's diversity disclosure requirement came into effect in 2009, there was a statistically significant increase in nationality diversity within treated firms compared to control group after the requirement implementation. This may imply that the SEC's policy had a notable effect on increasing transparency and possibly action towards improving TMT nationality diversity within treated firms. Column 2 to 4, which examine the effect on corporate carbon emissions, show significant negative results with coefficients of -0.0480, -0.0577, and -0.0399 for total carbon emission (Log_carbon_total), direct carbon emission (Log_carbon_direct), and indirect carbon emission (Log_carbon_indirect), respectively. The SEC's diversity disclosure requirement led to a reduction in carbon emissions among treated firms. This suggests that due to the promotion of TMT diversity after the SEC's diversity disclosure requirement, these firms were influenced to adopt practices that reduce their environmental footprint, possibly through more sustainable operation practices or increased scrutiny and accountability. The findings also imply that regulatory interventions focused on diversity disclosure can have broader positive impacts beyond their intended scope. By encouraging firms to report on diversity, regulators may also influence firms' behavior in other responsible dimensions, such as environmental stewardship.

Table 3
Diversity Disclosure Requirement Regulation S-K in 2009

Table 3 presents an analysis of the causal relationship between TMT nationality diversity and corporate carbon emissions based on the exogenous shock of Regulation S-K by the SEC in 2009, which requires the disclosure of firms' consideration of director diversity for US firms. The treatment group (Treat) comprises 504 US firms affected by the policy in 2009. The control group consists of firms in other countries, each matched to a treated firm based on firm characteristics from the year before the shock using the propensity score matching method (1 to 1 matching). We limit the analysis window to 3 years before and 3 years after the diversity disclosure shock, including the event year. Panel A compares the average values and t-statistics of the matching variables in the treatment and control groups before the diversity disclosure requirement. Panel B presents the regression results for the difference-in-differences model with a matching estimator. Dependent variables in Panel B include nationality diversity, the natural logarithm of total carbon emission (Log_total), direct carbon emission (Log_total_direct), and indirect carbon emission (Log_total_indirect), respectively. Post is equal to 1 for years after the treated firm is affected by the diversity disclosure policy and zero otherwise. Treat represents all US public firms, affected by the policy. The t-statistics (in parentheses) are based on firm-level robust standard errors. Control variables (omitted for brevity) are the same as those used in Table 2 (baseline regression). The table also provides the number of observations and R^2 values for each regression. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Details of each individual variable are defined in the Appendix.

Panel A

		Mean			%Reduction	T-test	
VARIABLES	Unmatched/ Matched	Treated	Control	%Bias	bias	t	P value
Nationality Diversity	U	0.2933	0.47907	-95.8		-30.06	0.000
	M	**0.2933**	**0.29869**	**-2.8**	**97.1**	**-1.02**	**0.309**
Log_asset	U	6.8162	6.7787	4.9		1.53	0.125
	M	**6.8162**	**6.7833**	**4.3**	**12.3**	**1.25**	**0.212**
Log_BM	U	-0.42132	-0.34726	-20.8		-6.65	0.000
	M	-0.42132	-0.44671	7.1	65.7	2.01	0.044
PPE	U	0.25845	0.24404	5.9		1.91	0.056
	M	**0.25845**	**0.2508**	**3.1**	**46.9**	**0.93**	**0.351**
Lev	U	0.34897	0.3849	-14.7		-4.70	0.000
	M	**0.34897**	**0.3366**	**5.0**	**65.6**	**1.50**	**0.133**
ROA	U	0.07188	0.0736	-1.7		-0.55	0.582
	M	**0.07188**	**0.07384**	**-2.0**	**-14.4**	**-0.55**	**0.580**

Panel B

VARIABLES	Nationality diversity	Log_carbon_total	Log_carbon_direct	Log_carbon_indirect
Treat*Post	**0.01995****	**-0.0480*****	**-0.0577*****	**-0.0399*****
	(2.03)	**(-4.523)**	**(-2.645)**	**(-3.934)**
Constant	0.42668**	1.504***	0.0993	1.600***
	(2.37)	(5.445)	(0.275)	(5.889)
Observations	3,911	3,911	3,911	3,911
R-squared	0.021	0.338	0.115	0.340
Controls	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Our research employs a parallel trend analysis to strengthen the findings in Table 3. Prior to SEC 2009, our analysis indicates no discernible trend in carbon emissions among the firm samples, suggesting consistent emission levels over time. However, following the implementation of SEC 2009 and subsequent diversity disclosure mandates, we observe a significant change in carbon emissions between the treatment and control groups. Specifically, companies with more nationally diverse TMTs tend to exhibit lower carbon emissions post-SEC 2009, implying that enhanced nationality diversity in TMT leads to improvement in addressing environmental concerns. These findings underscore the potential role of regulatory interventions in shaping corporate environmental strategies and highlight the importance of TMT diversity in fostering sustainable operation practices.

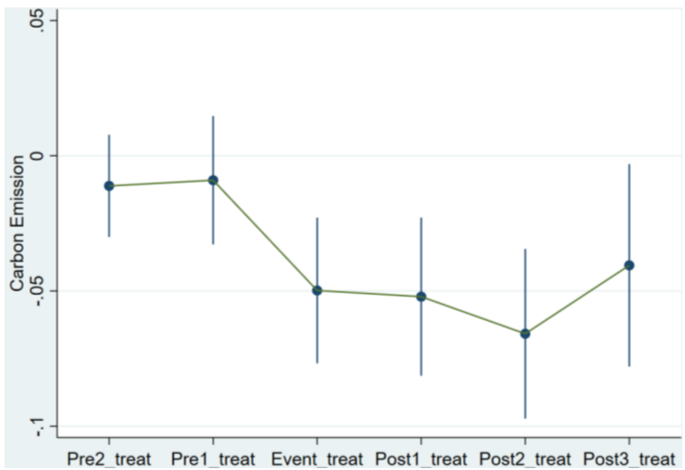


Figure 1. A parallel trend analysis illustrates the carbon emission level prior and post event of the SEC's diversity disclosure requirement in the US in 2009.

II. Evidence from CEO Death

We utilize CEO death as an exogenous shock in a difference-in-differences strategy. CEO death is considered a sudden and unexpected event that serves as a natural experiment for our study. This unexpected event has been used in several studies, including Chang and Wu (2020). The treated group consists of firms that experience a CEO death during the study period. These firms undergo a significant change in their leadership composition due to the unexpected CEO death event. The new CEO who replaces the deceased CEO may bring different priorities, strategies, and preferences regarding environmental concerns and sustainability, including those related to sustainable operation and carbon emissions. The control group consists of firms that do not experience CEO death during the study period, and they are assumed to follow a similar trend in carbon emissions over time as the treated group, in the absence of the CEO death shock. The testing model is as follows.

(9) $Y_{i,t} = \alpha + \beta_1 \text{Treat}_i \times \text{Post}_{i,t} + \sum_{k=2}^{n} \beta_k(\text{Control})_{i,t} + FE + \varepsilon_{i,t}$

where $Y_{i,t}$ is a generic variable for Nationality diversity, Log_carbon_total, Log_carbon_direct, and Log_carbon_indirect. Treat_i is equal to one for the treated firms that had experienced CEO death and zero otherwise. $\text{Post}_{i,t}$ is equal to one for the period following the firm CEO death event and zero otherwise. The coefficients of the interaction terms (β_1) capture changes in the differences between the treated and control groups for TMT nationality diversity and carbon emission measures around the death event.

Column 1 in Table 4 shows that after the occurrence of CEO death, there is a statistically significant decrease in nationality diversity with t-statistic at -4.889 ($p < 0.01$). This suggests that CEO death is associated with a reduction in nationality diversity within the treated firms, possibly indicating changes in leadership composition following CEO dismissal. The sudden death of a CEO can reduce TMT nationality diversity because some CEOs in our sample are from foreign countries and could be replaced by a local CEO. This applies to a portion of the sample, but it impacts the average effect. The possible reasons for not immediately hiring a foreign CEO after the sudden death event are that firms may prioritize stability with internal candidates who are familiar with the company's operations and culture (Kauhanen et al., 2012 and Tsoulouhas et al., 2007), and there are the logistical challenges involved in conducting a thorough external search amid urgent leadership needs, along with potential cultural and regulatory hurdles. Column 2 shows coefficient of 0.0301, demonstrating that after the CEO's death, which decreases TMT nationality diversity, there is a marginally significant increase in total carbon emissions or priorities related to environmental concerns. This may imply shifts in environmental strategies following CEO dismissal.

Table 4

CEO Death

Table 4 presents the identification strategy using CEO death as an exogenous shock in a difference-in-differences strategy. The dependent variables are nationality diversity and the natural logarithm of carbon emissions (Log_carbon_total, Log_carbon_direct, Log_carbon_indirect). Post equals 1 after the year of the firm CEO's death and 0 otherwise. Treat represents firms from all samples that experienced CEO death between 2002 and 2018. The t-statistics (in parentheses) are based on firm-level robust standard errors. Control variables (omitted for brevity) are the same as those used in table 2 (baseline regression). Additionally, the table provides the number of observations and R^2 values for each regression. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The detail of each individual variable is defined in the Appendix.

VARIABLES	(1) Nationality diversity	(2) Log_carbon_total	(3) Log_carbon_direct	(4) Log_carbon_indirect
Post*Treat	**-0.126***** **(-4.889)**	**0.0301*** **(1.706)**	-0.000571 (-0.0234)	0.0298 (1.586)
Constant	0.475*** (5.782)	0.598*** (4.608)	0.198 (0.939)	0.476*** (3.622)
Observations	29,488	29,488	29,488	29,488
R-squared	0.034	0.478	0.122	0.490
Controls	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES

III. Evidence from Instrumental Variable (IV) Test Using Country Immigration Percentage.

In Table 5, we use country immigration percentages[2/] from all countries (column 1-3) and from the top 20 countries ranked by EPI (column 4-6) as instruments for TMT nationality diversity. Immigration policies influence diversity practices within organizations, potentially affecting leadership demographics (Lauring and Selmer, 2010). There are broader benefits of diversity in corporate leadership, including enhanced decision-making and firm performance (Giannetti, Liao, and Yu, 2015). The first stage results show a positively significant coefficient at the 1% level for both IVs, with R^2 of 0.087 and 0.079, respectively. This suggests that these instruments effectively proxy for nationality diversity in the regression model. Higher levels of immigration from these groups are associated with higher levels of TMT nationality diversity, validating their usage as instruments. In the second stage regression, all coefficients of the estimated values of nationality diversity are negative and statistically significant at the 1% level,

[2/] Worldwide immigrant data from the United Nations with limited availability. Immigration data is sampled in specific years: 2000, 2005, 2015, 2019, and 2020. Link an R^2 of around 0.7. This indicates that higher TMT nationality diversity is associated with lower levels of corporate carbon emissions. Given the high t-statistics and consistently significant coefficients in all columns observed in the second stage, it suggests that the instruments are valid and help address potential endogeneity concerns in estimating the impact of TMT nationality diversity on corporate carbon emissions.

Table 5
Two-Stage Least Squares (2SLS) Regression Analysis

Table 5 presents the Two-Stage Least Squares (2SLS) regression analysis using the proportion of country immigration (from all countries) to total population in column 1 to 3 and the proportion of country immigration (from the top 20 EPI countries) to total population in column 4 to 6. The table displays both the first stage and second stage results. The t-statistics (in parentheses) are based on firm-level robust standard errors. Control variables (omitted for brevity) are the same as those used in table 2 (baseline regression). Additionally, the table provides the number of observations and R^2 values for each regression. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The detail of each individual variable is defined in the Appendix.

First stage result	Nationality Diversity	
Country Immigration	**0.9887*** 12.48**	
Top 20 EPI Immigration		**1.7279*** 9.93**
R^2	0.0876	0.0791

Second stage result	(1) Log_carbon_ total	(2) Log_carbon _direct	(3) Log_carbon _indirect	(4) Log_carbon _total	(5) Log_carbon_ direct	(6) Log_carbon _indirect
Nationality diversity	**-0.594*** (-3.944)**	**-1.021*** (-4.716)**	**-0.639*** (-4.247)**	**-0.535*** (-2.966)**	**-1.150*** (-4.345)**	**-0.547*** (-3.051)**
Constant	-0.630*** (-4.799)	-1.533*** (-8.122)	-0.515*** (-3.926)	-0.676*** (-4.460)	-1.434*** (-6.446)	-0.585*** (-3.887)
R-squared	0.778	0.695	0.764	0.781	0.686	0.770
Observations	6,329	6,329	6,329	6,329	6,329	6,329
Controls	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

IV. Channels Through Which TMT Nationality Diversity Reduces Carbon Emissions

I. The Effect of Variation in TMT Characteristics to Corporate Carbon Emissions

To investigate the variability in TMT characteristics to corporate carbon emissions, we categorize TMT members based on their countries of origin and corresponding EPI scores. This categorization serves to understand how carbon emission levels differ across firms with different environmental characteristics of TMT. Nations with higher EPI scores typically uphold stringent environmental standards and demonstrate heightened awareness of environmental concerns. As a result, the presence of TMT members from those countries can intensify the influence of TMT nationality diversity on corporate carbon emissions. Top managers originating from countries with high EPI scores often bring valuable insights and practices to their roles, which can bolster the firm's sustainability initiatives. Their influence is likely to be reflected in the adoption of best practices, active engagement in technological advancements aimed at reducing emissions, and alignment with a broader spectrum of stakeholder expectations. Consequently, we expect that the effect of TMT diversity in reducing carbon emissions should be stronger for companies with TMT members from high EPI score countries or environmentally proactive nations.

(10) $\text{Carbon\_emission}_{i,t} = \beta_0 + \beta_1 \text{High\_EPI}_{i,t} + \sum_{k=2}^{n} \beta_k (\text{Control})_{i,t} + \text{FE} + \varepsilon_{i,t}$

In Table 6, the independent variables decompose TMT nationality into two groups based on EPI score classifications. If the percentage of TMT members originating from countries ranking within the top 20 EPI countries is above an average of the whole samples, they are assigned to the 'High Environmental Concern' group (High_EPI); otherwise, they are assigned to the 'Low Environmental Concern' group (Low_EPI). The result reveals a statistically significant negative relationship with carbon emission levels in the High_EPI group. This finding supports our expectation that the effect of TMT in reducing carbon emissions is stronger for firms with TMT originating from countries with higher environmental performance. These foreign TMT members often possess heightened awareness of carbon emissions, leading them to pay closer attention to environmental concerns and be more prepared to address future challenges.

Table 6

The Effect of Variation in TMT Characteristics to Corporate Carbon Emissions

Table 6 shows heterogeneity in TMT characteristics by classifying firms' TMT nationality into high and low EPI groups and examines the relationship of each EPI group to carbon emission levels. This classification is based on the percentage of TMT members originating from countries ranked within the top 20 of EPI and use the average percentage of the whole samples to classify firms into high or low EPI groups. The dependent variables are firm carbon emission levels (total, direct, and indirect), measured by Log_carbon_total, Log_carbon_direct, and Log_carbon_indirect. The t-statistics (in parentheses) are based on firm-level robust standard errors. The table also presents the number of observations and R^2 values for each regression. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The detail of each individual variable is defined in the Appendix.

	(1)	(2)	(3)
VARIABLES	Log_carbon_total	Log_carbon_direct	Log_carbon_indirect
High_EPI	**-0.0648****	**-0.101***	-0.00965
	(-2.386)	**(-1.689)**	(-0.406)
Low_EPI	-0.0260	-0.00381	0.0354
	(-0.896)	(-0.0602)	(1.389)
Constant	1.445***	0.570	0.818***
	(4.841)	(1.223)	(4.630)
Observations	29,538	29,538	29,538
R-squared	0.473	0.121	0.137
Controls	YES	YES	YES
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

II. Green Technology Innovation

A nationally diverse TMT brings together individuals with different backgrounds, experiences, and perspectives. This diversity can foster creativity and innovation within the organization (An, Chen, Wu, and Zhang 2019). Cognitive diversity theory supports this idea because when organizations depend on a variety of human resources, this diversity can be seen as a valuable asset that enhances the organization's ability to innovate in response to changing external conditions. When faced with environmental concerns, a diverse team is more likely to generate a wider range of innovative ideas and solutions, including new green technologies, processes, or business models that enable the organization to operate more sustainably and reduce its environmental concerns. To measure firm-level green technology innovation, we follow previous literature by using the cumulative number of firm green patent applications, green patent grants, and the proportion of firm green patent grants to total green patents grants in the industry (Ghisellini et al., 2017; Kemp and Pearson, 2007). To demonstrate this mechanism, we regress TMT nationality diversity on the aforementioned proxies of green technology innovation, controlling relevant variables, firm fixed effects, and year fixed effects as follows.

$$(11) \quad \text{Green Innovation}_{i,t} = \beta_0 + \beta_1 \text{Nationality\_diversity}_{i,t} + \sum_{k=2}^{n} \beta_k (\text{Control})_{i,t} + FE + \varepsilon_{i,t}$$

In column 1 of Table 7, the estimated coefficient for TMT nationality diversity is 0.178, which is statistically significant with a t-statistic of 2.82. This coefficient indicates that an increase in TMT nationality diversity is associated with higher firm-level green technology innovation. In terms of economic significance, a one standard-deviation improvement in TMT nationality diversity leads to an increase in accumulated green patent grants by 4.06%. This finding suggests one of the mechanisms of the baseline relationship and implies that a more diverse nationality composition in the TMT contributes to increased green technology innovation within the organization. This result is consistent with the other two proxies used in columns 2 and 3, further bolstering the validity of this relationship.

Table 7
Green Technology Innovation

Table 7 presents the result of the effect of TMT nationality diversity on green technology innovation. The dependent variable is the firm-level green technology innovation, measured by the natural logarithm of the accumulated green patent grants, green patent applications, and the proportion of firm green patent grants to the total number of green patent grants in the industry (Green_patent_grant, Green_patent_application, %Green_patent_grant to industry). The primary variable of interest is Nationality diversity, which represents the proportion of nationally diverse TMT nationalities to TMT size. The t-statistics (in parentheses) are based on firm-level robust standard errors. The table also presents the number of observations and R^2 values. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The detail of each individual variable is defined in the Appendix.

VARIABLES	(1) Green_patent_ grant	(2) Green_patent_ application	(3) %Green_patent_grant to industry
Nationality diversity	**0.178*** **	**0.0720***	**0.0016***
	(2.823)	**(1.915)**	**(1.645)**
Log_asset	0.242***	0.250***	0.000984
	(2.757)	(4.363)	(0.549)
Log_BM	-2.696**	-0.656	0.0277
	(-2.160)	(-0.807)	(0.901)
PPE	-0.134	0.0445	-7.15e-06
	(-0.925)	(0.538)	(-0.00295)
LEV	0.238**	0.105**	0.000375
	(2.124)	(1.981)	(0.579)
ROA	0.380***	0.125**	0.00170
	(3.498)	(2.186)	(1.178)
Rev_growth	1.80e-06***	1.00e-06***	1.24e-08***
	(10.02)	(8.959)	(5.922)
Cash_to_asset	0.462***	0.366***	0.000651
	(3.372)	(4.070)	(0.402)
R&D_intensity	0.352	0.574**	0.00273
	(0.684)	(2.313)	(0.643)
Div_dummy	0.171***	0.0468**	-0.000259
	(4.136)	(2.159)	(-0.405)
Constant	-1.995***	-1.484***	-0.0110
	(-3.468)	(-3.921)	(-0.976)
Observations	29,488	29,488	29,488
R-squared	0.264	0.285	0.019
Number of firms	4,610	4,610	4,610
Controls	YES	YES	YES
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

III. Sustainable Operation and Supply Chain Management

To examine another possible channel—sustainable operations and supply chain management—we use the following equation to test the relationship between TMT nationality diversity and the implementation of sustainable practices in operations and supply chains (Sus_Oper).

(12) $$Sus\_Oper_{i,t} = \beta_0 + \beta_1 Nationality\_diversity_{i,t} + \sum_{k=2}^{n} \beta_k (Control)_{i,t} + FE + \varepsilon_{i,t}$$

Columns 2 and 8 in Table 8 demonstrate a significantly positive relationship between TMT nationality diversity and environmental material sourcing, as well as supplier termination based on environmental criteria, with coefficients of 1.1625 and 1.183, respectively. A one standard deviation increase in TMT nationality diversity is associated with a 26.5% and 27% higher likelihood, respectively, of engaging in environmental material sourcing and supplier termination based on environmental criteria. This implies that the presence of diverse perspectives and experiences, stemming from a variety of nationality backgrounds within the TMT, can enhance firms' sustainable operation with suppliers. This can potentially improve a firm’s competitive advantages by reducing environmental-related risks and enhancing public perception.

Table 8

Sustainable Operation and Supply Chain Management

Table 8 presents the effect of TMT nationality diversity on sustainable operation and supply chain management. The dependent variable is a dummy variable, which takes values of either 1 or 0, indicating the implementation of environmental procedures in operation and supply chain management (such as environmental material sourcing, environmental supply chain management, and supplier termination based on environmental criteria). Specifically, the dummy variable equals 1 if a firm reports conducting environmental practice in its operation or supply chain, and 0 otherwise. We use both logit and probit models, along with linear regression that incorporates time and firm fixed effects. The t-statistics (in parentheses) are based on firm-level robust standard errors. Additionally, the table provides the number of observations and R^2 values for each regression. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The detail of each individual variable is defined in the Appendix.

	Environmental material sourcing			**Environmental supply chain management**			**Supplier termination based on environmental criteria**		
VARIABLES	(1) Linear	(2) Logit	(3) Probit	(4) Linear	(5) Logit	(6) Probit	(7) Linear	(8) Logit	(9) Probit
Nationality Diversity	**0.0672**** **(2.483)**	**1.1625**** **(4.31)**	**0.289***** **(3.197)**	**0.0479**** **(2.476)**	0.478 (0.952)	**0.189*** **(1.841)**	**0.0631***** **(2.663)**	**1.183***** **(3.168)**	**0.330***** **(3.199)**
Constant	-0.514** (-2.357)		4.238*** (-15.81)	-0.712*** (-4.181)		-4.860*** (-15.31)	-0.268 (-1.351)		-3.883*** (-12.76)
Observations	17,750	6,970	17,750	19,728	8,380	19,728	17,536	4,697	17,536
R-squared	0.144		0.1681	0.498		0.5699	0.152		0.1591
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	NO	YES	YES	NO	YES	YES	NO
Year FE	YES	YES	NO	YES	YES	NO	YES	YES	NO

IV. Sustainable Corporate Governance Structure and Shareholder Demand on Green Proposal

Nationally diverse TMT may leverage their broader perspectives on environmental concerns to enhance the corporate governance practices of the firm they currently lead. We use the following equation to examine the relationship between TMT nationality diversity and the sustainable corporate governance (Gov_Struct).

(13) $$Gov\_Struct_{i,t} = \beta_0 + \beta_1 Nationality\_diversity_{i,t} + \sum_{k=2}^{n} \beta_k (Control)_{i,t} + FE + \varepsilon_{i,t}$$

In Table 9, column 1-7, we employ different models (linear probability, probit, logit) to examine the impact of TMT nationality diversity on various aspects of sustainable corporate governance, using proxies such as the ESG-compensation link and the presence of a sustainability committee. In column 1, TMT nationality diversity exhibits a coefficient of 0.0591 with a significance level of 2.285 ($p < 0.05$). Columns 2 and 3 (probit and logit models) also demonstrate similarly significant results, with positive coefficients of 0.536 and 0.932, respectively, both significant at $p < 0.01$. This suggests that a one standard deviation increase in TMT nationality diversity is associated with a 12.22% and 21.24% higher likelihood, respectively, of having an executive ESG-linked compensation structure. Column 5 shows a positive coefficient of 0.0525 (significant at $p < 0.05$), indicating that TMT nationality diversity positively influences the presence of a sustainability committee within companies. Column 6 and 7, using probit and logit models, respectively, further corroborate these findings with similarly positive and significant coefficients of 0.1938 and 1.4730 ($p < 0.01$), meaning that a one standard deviation increase in nationality diversity is associated with a 4.41% and 33.58% higher likelihood, respectively, of having a sustainability committee. This points out that TMT nationality diversity brings a broader perspective or different cultural values that prioritize environmental considerations in corporate governance structures. Alternatively, TMT from different nationalities may offer unique insights into sustainability practices in corporate governance structures prevalent or successful in their respective countries. This diversity can foster the exploration of alternative solutions or best practices in addressing environmental concerns.

Column 8 and 9 examine the percentage of green proposals to total proposals and show coefficients of 0.306 (significant at $p < 0.05$) and 0.113 (significant at $p < 0.1$), respectively, indicating a positive relationship with TMT nationality diversity. This suggests that companies with greater TMT nationality diversity tend to face or respond to higher shareholder demands for environmental concerns. This aligns with the idea that diverse perspectives may lead to increased awareness of or responsiveness to environmental concerns. In the other word, higher TMT nationality diversity could potentially enhance responsiveness to shareholder demands related to environmental concerns and meet evolving investor expectations regarding ESG.

Table 9

Sustainable Corporate Governance Structure and Shareholder Demand

Table 9 examines how TMT nationality diversity influences sustainable corporate governance and responsiveness to shareholder demand. In column 1 to 4, the dependent variable is a dummy variable that equals 1 if a firm has executive compensation tied to ESG performance, and 0 otherwise. Column 5 to 7 use a dummy variable as the dependent variable, which equals 1 if the firm has a sustainability committee, and 0 otherwise. Column 8 and 9 measure the natural logarithm of the number of shareholder green proposals and the proportion of shareholder green proposals to total shareholder proposals, but this proposal data is only available for US firms. The t-statistics (in parentheses) are based on firm-level robust standard errors. Additionally, the table provides the number of observations and R^2 values for each regression. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The detail of each individual variable is defined in the Appendix.

	ESG governance structure							**Shareholder demand**	
	ESG-linked compensation				Sustainability Committee			Number of green proposals	% Green proposals to total proposals
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Linear Model	Probit	Logit	Logit	Linear Model	Probit	Logit	Linear Model	Linear Model
Nationality Diversity	**0.0591****	**0.536*****	**0.932*****	-0.050	**0.0525****	**0.1938****	**1.4730*****	**0.306****	**0.113***
	(2.285)	**(6.278)**	**(6.347)**	(-0.2)	**(2.46)**	**(2.07)**	**(4.14)**	**(2.253)**	**(1.937)**
Constant	0.167	-3.993***	-6.989***		-0.2290	-4.1988		-0.249	-0.172
	(0.950)	(-17.19)	(-16.68)		(-1.39)	(-16.39)		(-0.250)	(-0.440)
Observations	26,260	27,338	27,338	10,847	21,263	21,263	5,195	2,638	2,638
R-squared	0.651	0.1282	0.1267		0.113	0.0622		0.146	0.024
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	NO	NO	YES	YES	NO	YES	YES	YES
Year FE	NO	NO	NO	YES	YES	NO	YES	YES	YES
Country*year FE	YES	NO	NO	NO	NO	NO	NO	NO	NO

V. Discussion

Our main finding reflects that the TMT nationality diversity helps enhance firm sustainability practices. This relationship can be understood through the lens of cultural intelligence theory, an ability to effectively adapt to the varied beliefs and social norms of different cultures. TMTs with high cultural intelligence are better equipped to understand and integrate diverse viewpoints, enabling them to implement more sustainability strategies. Nationally diverse TMT members, especially from countries with robust environmental regulations, are more likely to drive the implementation of effective green technology innovations. Their familiarity, knowledge and experience with stringent environmental standards and a broader understanding of their home and global green technology innovation enable them to implement better sustainable operation and corporate governance practices. Consistent with existing literature, García-Meca and Sánchez-Ballesta (2014) found that firms with diverse TMTs that included members from countries with high environmental standards were more likely to engage in environmentally friendly practices and Schmidt et al. (2020) highlights that multinational firms often adopt sustainable operation practices in their foreign operations, driven by top managers familiar with these practices from their home countries. This finding underscores the importance for firms to actively seek out nationally diverse TMT.

However, one might question why TMT nationality diversity would offer advantages over a TMT composed entirely of members from a country already highly advanced in sustainability, such as Norway. While Norway ranks highly in environmental performance and already enforces strict sustainability standards, firms led by entirely domestic TMTs may lack exposure to alternative practices, emerging innovations, or cultural approaches to sustainability found in other regions. The inclusion of TMT members from countries like Sweden, Denmark, Singapore or China can introduce unique sustainable initiatives and context-specific solutions that may improve the firm's current challenges or operating environment. This diversity can foster more dynamic dialogue and novel strategies that might not emerge in a culturally homogeneous team. While Norway is a leader in hydropower, electric vehicle adoption, and sustainable practices, other countries have advanced further in certain green technologies. For instance, Sweden and Denmark have effectively replaced oil in heating and power through waste-to-energy systems and biogas production, respectively—areas where Norway still has room to improve. Singapore has made significant progress in urban sustainability through smart infrastructure, and China leads globally in solar energy, driven by large-scale solar farm deployment and ongoing innovations in panel efficiency. By adopting these international solutions, Norway could further reduce its reliance on oil and strengthen its overall sustainability strategy. Therefore, TMT nationality diversity complements existing domestic knowledge and fills cognitive or experiential gaps, potentially enhancing sustainability outcomes even in high-standard environments, by effectively leveraging international networks and partnerships to combine strong local compliance with global adaptability and innovative perspectives.

While our study provides compelling evidence, there remains a need for further investigation. Future research should focus on conducting in-depth qualitative studies to uncover the mechanisms through which nationally diverse TMTs drive green innovation and sustainability practices, highlighting the specific strategies they employ. Additionally, it is essential to explore how global trends, particularly international collaboration, enhance the effectiveness of nationality diversity in reducing corporate carbon emissions. Industry-specific studies will be crucial, as certain sectors may exhibit heightened sensitivity to TMT diversity and environmental impact. Furthermore, examining the intersection of nationality diversity with other forms of diversity—such as gender and educational background—will provide a more nuanced understanding of how nationally diverse TMT can effectively contribute to improved sustainable operation.

VI. Conclusion

Our research provides evidence that higher TMT nationality diversity is associated with lower corporate carbon emissions. We employ difference-in-differences method as an identification test, using diversity disclosure requirements by the SEC and CEO death as exogenous shocks to establish the causal link. The underlying mechanism is that nationally diverse TMTs, especially those from countries with higher environmental standards, introduce green technology innovations and implement more sustainable corporate governance through ESG-linked executive compensation and sustainability committees. Leveraging their broader sustainable perspective, these nationally diverse TMTs also promote higher sustainable operations through the implementation of sustainable supply chain and material management.

Covering 4,610 public firms across 52 countries from 2002 to 2019, the findings underscore broader implications for global organizational effectiveness and environmental efforts resulting from TMT composition and demographics. Apart from contributing to scholarly understanding, our findings highlight strategies to combat environmental concerns while maintaining competitiveness. This informs practical strategies for managers, investors, and policymakers aiming to integrate diversity initiatives with sustainability goals in a dynamic business environment. Our research sheds light internationally on the potential benefits of diversity initiatives for mitigating environmental concerns and promoting sustainable development. Ultimately, our work advances knowledge in the sustainability field and supports efforts to foster diversity and inclusion in corporate leadership roles.

Appendix

Variable Definition.

Nationality diversity	The total number of distinct TMT nationalities to the total number of TMT members (firm level).
Log_carbon_total	The natural logarithm of the total carbon emission amount (including direct and indirect carbon emissions).
Log_carbon_direct	The natural logarithm of direct carbon emission amount.
Log_carbon_indirect	The natural logarithm of indirect carbon emission amount.
Carbon_intensity_total	The natural logarithm of total carbon emission amount to total revenue.
Carbon_intensity_direct	The natural logarithm of direct carbon emission amount to total revenue.
Carbon_intensity_indirect	The natural logarithm of indirect carbon emission amount to total revenue.
Log_asset	The natural logarithm of total assets (in US currency).
Log_BM	The natural logarithm of the total book value of capital equity to the market value of equity (price multiplied by total shares outstanding).
PPE	Net property, plant, and equipment to total assets.
Lev	Total debt to total assets.
ROA	Operating income before depreciation to total assets.
Green_patent_grant	Cumulative number of green patents grants.
Green_patent_application	Cumulative number of green patent applications.
%Green_patent_grant to industry	Number of green patent grants relative to the total number of green patent grants in the industry (Using GICS 11 sectors).
Environmental material sourcing	A dummy variable of 1 or 0, with a value of 1 if the company prioritizes using materials that have a lower environmental footprint throughout their life cycle and eliminates materials that have significant negative environmental impacts, and 0 otherwise.
Environmental supply chain management	A dummy variable of 1 or 0, taking a value of 1 if the company uses environmental criteria such as ISO 14000 certification and energy consumption metrics in the selection process of its suppliers or sourcing partners, and 0 otherwise.
Supplier termination	A dummy variable of 1 or 0, with a value of 1 if the company reports or shows readiness to end a partnership with a sourcing partner if environmental criteria are not met, and 0 otherwise.
Rev_growth	Percentage change of total revenue.
Cash_to_asset	Free cash flow from operations to total assets.
Rd_intensity	Research and development expenditure to total revenue.

Div_dummy	A dummy variable of 1 or 0, with a value of 1 if the company pays dividends, and 0 otherwise.
ESG_linked compensation	A dummy variable of 1 or 0, with a value of 1 if the company's compensation policy includes remuneration for the CEO, executive directors, non-board executives, and other management bodies based on ESG or sustainability factors, and 0 otherwise.
Number of green proposals	The total number of environmental-related proposals by shareholders in each period.
% Green proposal to total	The number of environmental-related proposals to the total number of proposals (across all agendas).
EPI	The Environmental Performance Index provides a data-driven summary of the state of sustainability around the world. Using 58 performance indicators across 11 issue categories, the EPI ranks 180 countries on climate change performance, environmental health, and ecosystem vitality. These indicators gauge, at a national scale, how close countries are to established environmental policy targets. The EPI offers a scorecard that highlights leaders in environmental performance and provides practical guidance for countries aspiring to move toward a sustainable future. (Data source: Yale Center for Environmental Law & Policy, Wolf, M. J., Emerson, J. W., Esty, D. C., de Sherbinin, A., Wendling, Z. A., et al., 2022).
Perc_top_EPI	Percentage of the company's TMT members who come from the top 20 highest scores in the Environmental Performance Index.
High_EPI	Companies with Perc_top_EPI above the average of total samples.
Low_EPI	Companies with Perc_top_EPI below the average of total samples
Migration	The number of immigrants from all countries to the total number of population.
EPI_immigration	The number of immigrants from top 20 countries on EPI score to the total number of population.

References

Adediran. (2023). Disclosing Corporate Diversity. *Virginia Law Review*, 109(307).

Amason, A. C., Liu, J., & Fu, P. (2018). Value Heterogeneity: An Overlooked and Important Antecedent of TMT Conflict and Effectiveness. *Journal of Managerial Issues, 30*(2), 155-182.

An, H., Chen, C. R., Wu, Q., & Zhang, T. (2021). Corporate innovation: Do diverse boards help? *Journal of Financial and Quantitative Analysis, 56*(1), 155-182.

Azar, J., Duro, M., Kadach, I., et al. (2021). The Big Three and corporate carbon emissions around the world. *Journal of Financial Economics*.

Berscheid, E., & Hatfield-Walster, E. (1969). Interpersonal Attraction. Menlo Park, CA: Addison-Wesley.

Biswas, P. K., Roberts, H., & Stainback, K. (2021). Does women's board representation affect non-managerial gender inequality? Human Resource Management, 60(4), 659-680.

Bolton, P., & Kacperczyk, M. (2023). Global pricing of carbon-transition risk. *The Journal of Finance*.

Boone, C., Lokshin, B., Guenter, H., & Belderbos, R. (2019). Top management team nationality diversity, corporate entrepreneurship, and innovation in multinational firms. *Strategic Management Journal, 40*, 277-302.

Cao, J., Zhan, X., Zhang, W., & Zhang, Y. (2023). Foreign institutional ownership and corporate carbon emissions. Working paper.

Carradori, O., Giuzio, M., Kapadia, S., Salakhova, D., & Vozian, K. (2023). Firm leverage and the low-carbon transition in Europe. *SUERF Policy Brief, No. 728*. Retrieved from https://www.suerf.org/policynotes/16254/firm-leverage-and-the-low-carbon-transition-in-europe

Chang, C.-H., & Wu, Q. (2021). Board networks and corporate innovation. *Management Science, 67*(6), 3618-3654.

Cohen, S., Kadach, I., Ormazabal, G., & Reichelstein, S. (2023). Executive compensation tied to ESG performance: International evidence. *Journal of Accounting Research, 61*(3), 385-415.

Dahms, S., Kingkaew, S., & Ng, E. S. (2020). The effects of top management team national diversity and institutional uncertainty on subsidiary CSR focus. *Journal of Business Ethics*. Advance online publication.

Dauth, T., Pronobis, P., & Schmid, S. (2017). Exploring the link between internationalization of top management and accounting quality: The CFO's international experience matters. *International Business Review, 26*, 71-88.

Dinniyah, T., & Nuzula, N. F. (2021). The influence of environmental cost on profitability and firm value: A study of First Section chemical companies listed on Japan Stock Exchange in 2016–2018. *Advances in Economics, Business and Management Research, 191*.

Fox, B. C., Simsek, Z., & Heavey, C. (2022). Top management team experiential variety, competitive repertoires, and firm performance: Examining the law of requisite variety in the 3D printing industry (1986–2017). *Academy of Management Journal, 65*(2), 545-576.

Few, W. T., & Joshi, M. (2013). Top management team decision making: The role of functional and organizational identities on the outcomes of TMT diversity. *European Journal of International Management, 7*(1), 56-73.

Genin, A., Ma, W., Bhagwat, V., & Bernile, G. (2023). Board experiential diversity and corporate radical innovation. *Strategic Management Journal, 1-24*.

Ghisetti, C., & Quatraro, F. (2017). Green technologies and environmental productivity: A cross-sectoral analysis of direct and indirect effects in Italian regions. *Ecological Economics, 132*, 1-13.

Giannetti, M., Liao, G., & Yu, X. (2015). The brain gain of corporate boards: Evidence from China. *The Journal of Finance, 70*(4).

Giannetti, M., & Zhao, M. (2019). Board ancestral diversity and firm-performance volatility. *Journal of Financial and Quantitative Analysis, 54*(3), 1117-1155.

Gormley, T. A., Gupta, V. K., Matsa, D. A., Mortal, S. C., & Yang, L. (2023). The Big Three and board gender diversity: The effectiveness of shareholder voice. *Journal of Financial Economics, 149*, 323-348.

Gould, E. R., Tarbox, J., & Coyne, L. (2018). Evaluating the effects of Acceptance and Commitment Training on the overt behavior of parents of children with autism. Journal of Contextual Behavioral Science, 7, 81-88.

García-Meca, E., & Sánchez-Ballesta, J. P. (2014). "The effect of board diversity on the corporate social responsibility of Spanish firms." *Journal of Business Ethics*, 123(4), 683-698.

Greve, P., Biemann, T., & Ruigrok, W. (2015). Foreign executive appointments: A multilevel examination. *Journal of World Business, 50*(4), 674-686.

Griffin, D., Li, K., & Xu, T. (2021). Board gender diversity and corporate innovation: International evidence. *Journal of Financial and Quantitative Analysis, 56*(1), 123-154.

Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review, 9*(2), 193-206.

Hambrick, D. C., & Chen, M. J. (1996). The influence of top management team heterogeneity on firms' competitive moves. *Administrative Science Quarterly, 41*(4), 659-684.

Iliev, P., & Roth, L. (2023). Director expertise and corporate sustainability. *Review of Finance, 2085-2123*.

Kang, J.-K., Kim, S., & Oh, S. (2022). Does board demographic diversity enhance cognitive diversity and monitoring? *The Accounting Review, 97*(6), 385-415.

Kauhanen, A., & Napari, S. (2012). Career and wage dynamics: Evidence from linked employer employee data. In Research in labor economics (Vol. 36, pp. 35-76). Emerald Group Publishing Limited.

Kemp, R., & Pearson, P. (2007). Final Report of the MEI Project Measuring Eco Innovation. OECD. Retrieved from https://www.oecd.org/greengrowth/consumption-innovation/43960830.pdf

Kogan, L., Papanikolaou, D., Seru, A., & Stoffman, N. (2011). Technological innovation, resource allocation, and growth. Working Paper 17769. National Bureau of Economic Research.

Li, W., Zhang, J. Z., & Ding, R. (2023). Impact of directors' network on corporate social responsibility disclosure: Evidence from China. *Journal of Business Ethics, 183*, 551-583.

Luong, H., Moshirian, F., Nguyen, L., Tian, X., & Zhang, B. (2017). How do foreign institutional investors enhance firm innovation? *The Journal of Financial and Quantitative Analysis, 52*(4), 1449-1490.

Ma, S., Kor, Y. Y., & Seidl, D. (2022). Top management team role structure: A vantage point for advancing upper echelons research. *Strategic Management Journal, 43*(8), O1-O28.

McPherson, M., Smith-Lovin, L., & Cook, J. M. (2001). Birds of a feather: Homophily in social networks. Annual Review of Sociology, 27, 415-444.

Melis, A., & Nawaz, T. (2023). The impact of CEOs' personal traits on organisational performance: Evidence from faith-based charity organisations. *Journal of Business Ethics*. Advance online publication.

Meng, S., Wang, P., & Yu, J. (2022). Going abroad and going green: The effects of top management teams' overseas experience on green innovation in the digital era. *International Journal of Environmental Research and Public Health, 19*(14), 14705.

Ng, E. S., & Sears, G. J. (2020). Walking the talk on diversity: CEO beliefs, moral values, and the implementation of workplace diversity practices. *Journal of Business Ethics, 164*(3), 437-450.

Quan, X.; Ke, Y.; Qian, Y.; Zhang, Y. CEO foreign experience and green innovation: Evidence from China. J. Bus. Ethics 2021, 1–23.

Rixom, J. M., Jackson, M., & Rixom, B. A. (2023). Mandating diversity on the board of directors: Do investors feel that gender quotas result in tokenism or added value for firms? *Journal of Financial and Quantitative Analysis*.

Schwartz-Ziv, M., & Weisbach, M. S. (2013). What do boards really do? Evidence from minutes of board meetings. *Journal of Financial Economics, 108*(2), 349-366.

Selmer, J., & Lauring, J. (2010). Self-initiated academic expatriates: Inherent demographics and reasons to expatriate. *European Management Review, 7*, 169-179.

Schmidt, C., & Kauffmann, S. (2020). "Sustainability practices in multinational firms: The role of top management." *Journal of International Business Studies*, 51(3), 451-477.

Tsoulouhas, T., Knoeber, C. R., & Agrawal, A. (2007). Contests to become CEO: incentives, selection and handicaps. Economic Theory, 30, 195-221.

Wolf, M. J., Emerson, J. W., Esty, D. C., de Sherbinin, A., Wendling, Z. A., et al. (2022). 2022 Environmental Performance Index. New Haven, CT: Yale Center for Environmental Law & Policy.

Wu, J., Richard, O. C., Triana, M. C., & Zhang, X. (2022). The performance impact of gender diversity in the top management team and board of directors: A multiteam systems approach. *Human Resource Management, 61*, 157-180.

Zhou, Y., Zhou, Y., Zhang, L., Zhao, X., & Chen, W. (2022). Effects of top management team characteristics on patent strategic change and firm performance. *Frontiers in Psychology, 12*, Article 762499.

Zhou, L., Huang, H., Chen, X., & Tian, F. (2023). Functional diversity of top management teams and firm performance in SMEs: A social network perspective. *Review of Managerial Science, 17*, 259-286.

Narayan, S., Sidhu, J. S., & Volberda, H. W. (2021). From attention to action: The influence of cognitive and ideological diversity in top management teams on business model innovation. *Journal of Management Studies, 58(8)*, 2082-2110.

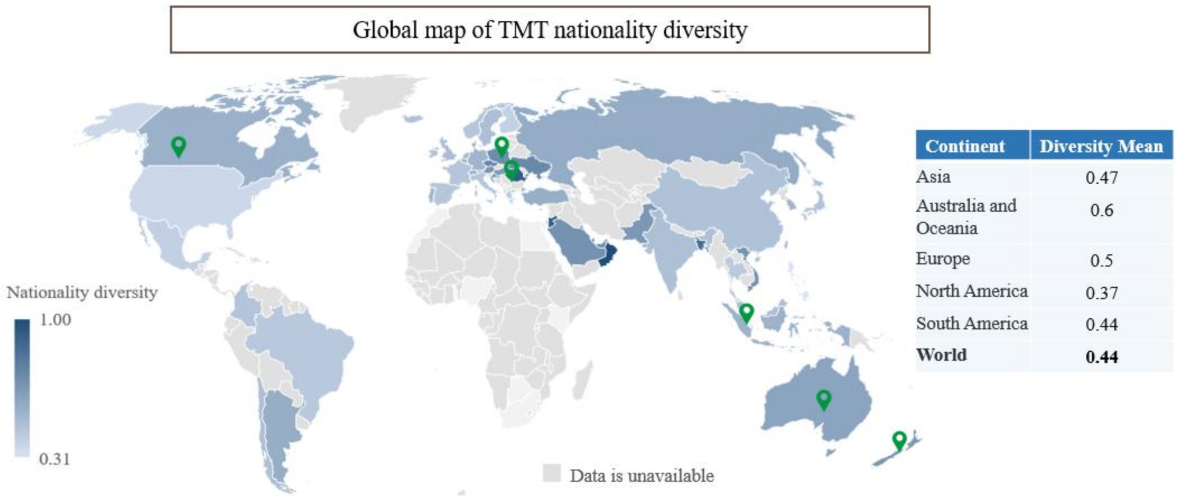
Xie, Y., & Liu, L. (2022). Board gender diversity and corporate environmental performance: Evidence from the global context. *Journal of Business Ethics*, 177(4), 937-955. https://doi.org/10.1007/s10551-020-04568-4.

Bonini, S., & Oppenheim, J. (2020). The influence of consumer preferences on corporate carbon footprints: A cross-country analysis. *Journal of Business Ethics, 165*(4), 685-700. https://doi.org/10.1007/s10551-019-04156-8.

Supporting Information

Figure 2

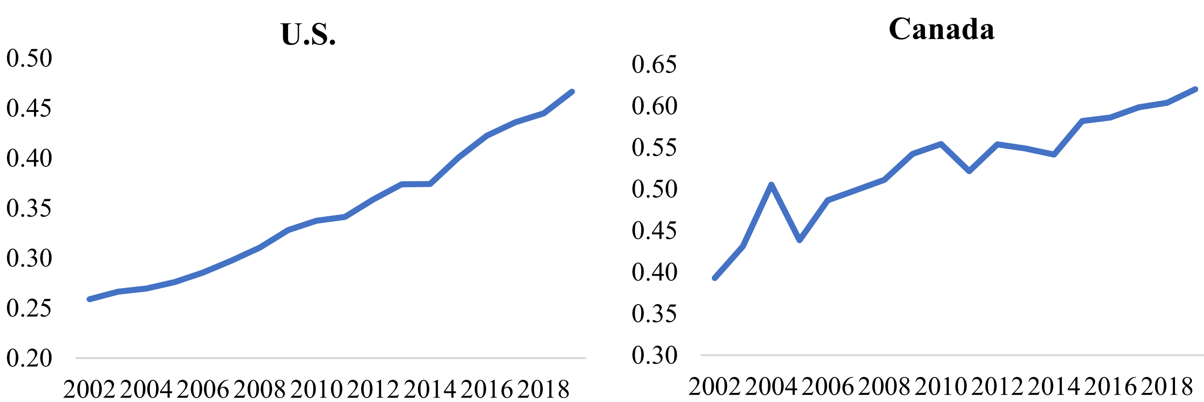
Global map of TMT nationality diversity.

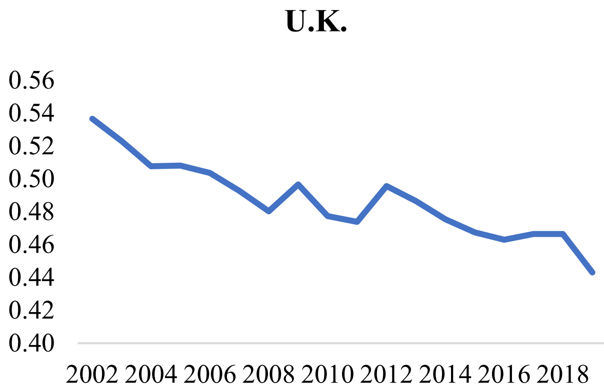


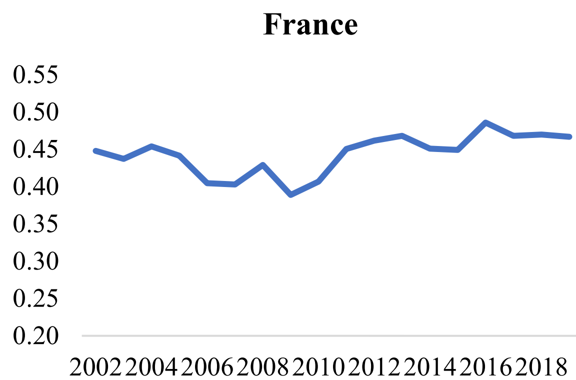
Continent	Diversity Mean
Asia	0.47
Australia and Oceania	0.6
Europe	0.5
North America	0.37
South America	0.44
World	**0.44**

Figure 3

The trend of TMT nationality diversity in major countries from 2002 to 2019.




U.K.
0.56
0.54
0.52
0.50
0.48
0.46
0.44
0.42
0.40
2002 2004 2006 2008 2010 2012 2014 2016 2018


France
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
2002 2004 2006 2008 2010 2012 2014 2016 2018


China
0.55
0.50
0.45
0.40
0.35
0.30
2002 2004 2006 2008 2010 2012 2014 2016 2018

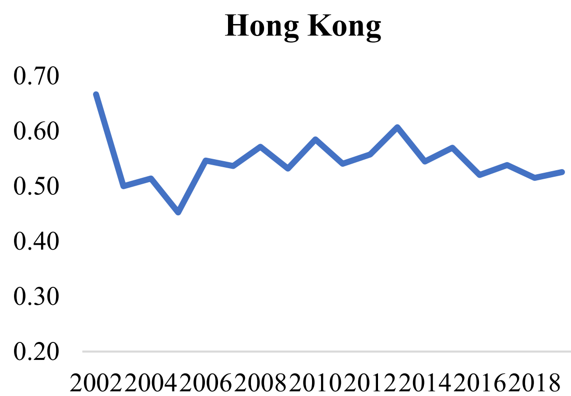

Hong Kong
0.70
0.60
0.50
0.40
0.30
0.20
2002 2004 2006 2008 2010 2012 2014 2016 2018

Table 10 Summary statistics

The table reports the country-level summary statistics covering mean, standard deviation, 25th percentile, 75th percentile, minimum value and maximum value of TMT nationality diversity, total carbon emission level, direct carbon emission level, and indirect carbon emission level, respectively. Details of each variable are defined in the Appendix.

Country	Nationality diversity						Natural Logarithm of Direct Carbon Emission						Natural Logarithm of Indirect Carbon Emission						Natural Logarithm of Total Carbon Emission						# of samples
	Mean	SD	P25	P75	Min	Max	Mean	SD	P25	P75	Min	Max	Mean	SD	P25	P75	Min	Max	Mean	SD	P25	P75	Min	Max	
Australia	0.6	0.2	0.5	0.8	0.2	1.0	5.3	1.0	4.7	5.8	1.9	7.8	4.2	1.2	3.3	4.9	0.1	7.4	5.2	1.0	4.6	5.8	1.6	7.6	549
Austria	0.7	0.3	0.5	1.0	0.3	1.0	5.8	0.9	5.3	6.5	3.1	7.5	5.0	1.3	4.1	6.2	2.3	7.2	5.7	0.8	5.2	6.1	3.0	7.3	160
Belgium	0.6	0.2	0.4	0.7	0.1	1.0	5.5	1.0	4.8	6.2	2.1	7.5	4.6	1.1	3.9	5.3	1.2	7.1	5.5	1.0	4.7	6.1	2.1	7.4	295
Bermuda	0.6	0.2	0.5	0.7	0.2	1.0	5.1	0.6	4.7	5.5	3.4	6.8	3.9	1.2	3.0	4.9	1.5	6.3	5.0	0.5	4.7	5.4	3.4	6.6	140
Brazil	0.4	0.2	0.3	0.5	0.1	1.0	5.4	0.8	4.9	6.0	4.0	7.6	4.3	1.1	3.5	5.0	1.6	7.3	5.3	0.8	4.8	5.9	3.9	7.3	261
Canada	0.5	0.2	0.3	0.7	0.1	1.0	5.8	0.8	5.4	6.3	2.7	7.5	4.8	1.1	4.2	5.5	1.8	7.3	5.7	0.8	5.3	6.1	2.7	7.3	752
Chile	0.5	0.2	0.3	0.5	0.2	1.0	5.9	0.8	4.9	6.5	4.6	7.1	5.0	1.2	3.6	6.2	3.3	7.1	5.7	0.6	4.9	6.3	4.6	6.5	46
China	0.5	0.2	0.3	0.5	0.1	1.0	5.6	1.0	4.9	6.3	1.7	8.3	4.5	1.2	3.7	5.4	0.8	7.9	5.5	1.0	4.9	6.2	1.7	8.1	316
Colombia	0.5	0.1	0.3	0.5	0.3	1.0	5.3	0.8	4.8	5.7	4.7	7.2	3.9	1.5	2.8	5.5	2.0	6.9	5.2	0.6	4.8	5.2	4.7	6.9	26
Czech	0.7	0.2	0.5	1.0	0.5	1.0	4.9	0.4	4.5	5.3	4.4	5.4	3.8	0.5	3.3	4.1	3.1	4.3	4.9	0.4	4.4	5.2	4.3	5.4	12
Denmark	0.5	0.2	0.4	0.7	0.1	1.0	5.4	0.8	5.0	5.9	2.2	6.8	4.1	0.9	3.6	4.5	1.1	6.6	5.3	0.8	5.0	5.8	2.1	6.4	217
Finland	0.4	0.2	0.3	0.5	0.1	1.0	5.8	0.8	5.2	6.4	3.2	7.3	4.5	1.2	3.9	5.2	1.0	7.1	5.8	0.8	5.2	6.3	3.2	7.0	292
France	0.4	0.2	0.3	0.5	0.0	1.0	6.0	1.0	5.3	6.7	2.1	8.2	4.8	1.2	4.0	5.5	0.4	8.0	5.9	1.0	5.2	6.6	2.0	8.0	1,283
Germany	0.5	0.2	0.3	0.6	0.1	1.0	5.9	1.0	5.3	6.6	2.4	8.2	4.8	1.2	4.0	5.5	0.6	8.1	5.9	0.9	5.2	6.6	2.4	7.9	1,101
Greece	0.4	0.2	0.3	0.5	0.2	1.0	5.4	0.5	5.1	5.7	4.5	6.9	4.0	0.8	3.4	4.4	2.8	6.6	5.4	0.5	5.0	5.7	4.5	6.7	53
Hong Kong	0.5	0.2	0.5	0.5	0.1	1.0	5.7	0.8	5.2	6.2	3.1	7.4	4.5	1.2	3.7	5.2	0.6	7.1	5.6	0.7	5.1	6.1	3.0	7.4	424
India	0.5	0.2	0.3	0.5	0.1	1.0	5.4	0.8	4.8	5.9	3.6	7.8	4.3	1.0	3.7	4.9	2.0	7.5	5.3	0.7	4.7	5.8	3.6	7.5	503
Indonesia	0.5	0.2	0.4	0.7	0.1	1.0	5.1	0.6	4.7	5.4	3.9	7.1	4.0	0.8	3.3	4.5	2.7	6.7	5.0	0.5	4.6	5.2	3.8	6.9	155
Israel	0.5	0.2	0.3	0.5	0.1	1.0	5.2	1.0	4.5	5.6	2.8	7.4	4.2	1.3	3.2	5.0	1.6	7.2	5.1	0.9	4.5	5.4	2.8	6.9	131
Italy	0.4	0.2	0.3	0.5	0.1	1.0	5.7	1.0	5.2	6.3	2.4	8.1	4.5	1.2	3.8	5.2	0.5	7.8	5.6	1.0	5.1	6.1	2.3	7.8	361

Country	Nationality diversity						Natural Logarithm of Direct Carbon Emission						Natural Logarithm of Indirect Carbon Emission						Natural Logarithm of Total Carbon Emission						# of samples
	Mean	SD	P25	P75	Min	Max	Mean	SD	P25	P75	Min	Max	Mean	SD	P25	P75	Min	Max	Mean	SD	P25	P75	Min	Max	
Japan	0.5	0.2	0.3	0.5	0.0	1.0	6.4	0.8	6.0	7.0	3.8	7.9	5.3	1.0	4.6	6.0	2.2	7.3	6.4	0.7	6.0	6.9	3.8	7.9	823
Luxemburg	0.7	0.2	0.5	0.8	0.3	1.0	5.3	0.7	5.0	5.9	3.8	7.0	4.4	0.8	3.7	5.3	3.1	6.3	5.2	0.7	5.0	5.8	3.7	6.9	76
Macao	1.0	0.0	1.0	1.0	1.0	1.0	5.5	0.2	5.4	5.7	5.3	5.8	4.1	0.6	3.6	4.9	3.6	4.9	5.5	0.2	5.3	5.7	5.3	5.7	7
Malaysia	0.5	0.3	0.3	0.5	0.1	1.0	5.2	0.8	4.6	5.7	1.1	7.0	4.1	1.1	3.5	4.7	0.2	6.9	5.0	0.8	4.6	5.6	1.0	6.6	426
Malta	0.6	0.2	0.4	0.7	0.3	1.0	4.1	0.4	3.9	4.4	3.4	4.8	2.4	0.4	2.2	2.9	1.6	3.0	4.1	0.4	3.8	4.4	3.4	4.8	19
Mexico	0.4	0.2	0.3	0.5	0.3	1.0	5.3	0.7	4.7	5.8	4.5	6.6	4.5	0.8	4.0	5.5	3.5	5.9	5.1	0.7	4.6	5.8	4.4	6.5	21
Netherlands	0.5	0.2	0.3	0.6	0.1	1.0	5.6	0.9	5.0	6.2	2.8	7.3	4.4	1.0	3.8	5.2	1.7	6.6	5.5	0.9	5.0	6.0	2.7	7.2	582
New Zealand	0.7	0.2	0.5	1.0	0.3	1.0	5.7	1.0	4.9	6.6	3.5	6.7	4.9	1.5	3.6	6.5	1.6	6.6	5.3	0.8	4.9	5.7	3.4	6.7	31
Nigeria	0.9	0.2	1.0	1.0	0.3	1.0	4.8	0.6	4.2	5.3	3.9	6.4	3.7	0.9	2.7	4.5	2.2	6.0	4.8	0.6	4.2	5.3	3.8	6.2	35
Norway	0.4	0.2	0.3	0.5	0.1	1.0	5.5	1.3	4.8	6.3	0.7	7.8	4.3	1.7	3.3	5.5	0.3	7.4	5.4	1.3	4.6	6.3	0.6	7.7	264
Philippines	0.3	0.2	0.2	0.4	0.1	1.0	5.3	0.8	4.8	5.9	3.6	7.4	4.4	1.1	3.6	4.9	0.9	7.2	5.2	0.7	4.7	5.7	3.5	7.1	377
Poland	0.7	0.2	0.5	1.0	0.3	1.0	5.4	1.0	4.7	6.4	4.3	7.4	4.3	1.4	3.5	5.5	2.9	7.0	5.3	0.9	4.7	6.3	4.3	7.1	41
Portugal	0.5	0.2	0.5	0.5	0.3	1.0	5.8	0.5	5.8	6.1	4.4	7.1	4.8	0.7	4.3	5.2	2.9	6.6	5.8	0.5	5.7	5.9	4.4	7.0	51
Puerto Rico	0.5	0.3	0.2	1.0	0.1	1.0	4.7	0.2	4.6	4.8	4.2	4.9	3.2	0.3	3.2	3.4	2.7	3.5	4.7	0.2	4.6	4.8	4.2	4.9	22
Qatar	0.9	0.2	0.8	1.0	0.5	1.0	4.9	0.5	4.5	5.3	4.4	5.8	3.6	0.6	3.2	4.1	2.8	4.6	4.9	0.5	4.5	5.3	4.4	5.8	21
Ireland	0.5	0.2	0.3	0.5	0.1	1.0	5.7	0.9	5.2	6.4	1.9	7.6	4.6	0.9	4.1	5.2	0.6	7.4	5.7	0.9	5.1	6.3	1.9	7.3	314
Romania	0.9	0.2	1.0	1.0	0.5	1.0	6.6	0.3	6.6	6.7	6.0	6.8	6.3	0.2	6.1	6.5	5.8	6.5	6.2	0.4	6.2	6.4	5.3	6.4	7
Russia	0.6	0.2	0.5	0.5	0.2	1.0	6.4	1.1	5.8	7.2	4.4	8.0	5.6	1.6	5.0	6.9	2.4	7.6	6.2	1.0	5.7	6.9	4.4	7.8	67
Saudi Arabia	0.7	0.3	0.5	1.0	0.2	1.0	5.3	1.1	4.7	5.2	4.4	7.9	4.2	1.5	3.3	4.2	3.0	7.6	5.3	1.0	4.6	5.2	4.4	7.6	26
Singapore	0.6	0.2	0.5	0.7	0.2	1.0	5.4	0.9	4.8	5.9	3.6	7.7	4.2	1.1	3.5	4.8	2.0	6.6	5.3	0.9	4.8	5.9	3.5	7.6	184
South Africa	0.6	0.2	0.5	0.7	0.2	1.0	5.4	0.8	4.8	6.0	2.3	7.0	4.2	1.3	3.3	5.0	1.2	6.7	5.3	0.8	4.7	5.9	2.3	6.8	319
South Korea	0.5	0.2	0.5	0.5	0.2	1.0	6.4	0.8	5.6	7.1	4.9	8.0	5.4	1.1	4.2	6.4	3.5	7.9	6.3	0.8	5.5	6.9	4.9	7.7	80
Spain	0.4	0.2	0.3	0.5	0.1	1.0	6.0	0.9	5.3	6.7	3.6	7.8	4.9	1.3	4.0	5.7	2.0	7.6	5.9	0.8	5.3	6.5	3.6	7.6	297
Sweden	0.5	0.2	0.3	0.5	0.1	1.0	5.5	0.9	4.9	6.1	1.4	7.2	4.4	1.1	3.7	5.1	0.4	7.0	5.4	0.8	4.8	6.1	1.4	6.9	468
Switzerland	0.6	0.2	0.4	0.7	0.1	1.0	5.4	1.0	4.8	6.1	0.1	8.0	4.2	1.1	3.6	4.9	0.8	7.4	5.4	1.0	4.7	6.1	0.0	8.0	1,185

Country	Nationality diversity						Natural Logarithm of Direct Carbon Emission						Natural Logarithm of Indirect Carbon Emission						Natural Logarithm of Total Carbon Emission						# of samples
	Mean	SD	P25	P75	Min	Max	Mean	SD	P25	P75	Min	Max	Mean	SD	P25	P75	Min	Max	Mean	SD	P25	P75	Min	Max	
Taiwan	0.5	0.2	0.3	0.5	0.0	1.0	5.5	0.8	4.9	6.0	0.0	7.7	4.2	1.0	3.4	4.9	0.8	6.7	5.4	0.8	4.9	5.9	0.0	7.7	750
Thailand	0.4	0.2	0.3	0.5	0.1	1.0	5.4	1.0	4.7	6.0	3.5	7.7	4.3	1.4	3.3	5.2	1.1	7.5	5.3	0.9	4.7	5.9	3.5	7.2	167
Turkey	0.6	0.3	0.3	0.7	0.1	1.0	5.4	0.6	5.1	5.6	4.7	7.1	4.2	0.8	3.6	4.5	3.0	6.6	5.4	0.6	5.1	5.6	4.7	6.9	69
UAE	0.7	0.3	0.5	1.0	0.2	1.0	5.0	0.7	4.8	5.5	3.1	6.2	4.0	0.9	3.2	4.7	1.9	5.8	4.9	0.7	4.6	5.4	3.0	6.0	57
England	0.5	0.2	0.3	0.5	0.1	1.0	5.1	0.9	4.4	5.8	1.6	7.8	4.0	1.2	3.2	4.8	0.0	7.4	5.1	0.9	4.4	5.7	1.5	7.6	3,249
US	0.4	0.2	0.2	0.5	0.0	1.0	5.7	0.9	5.1	6.3	0.1	8.6	4.6	1.1	3.9	5.3	2.0	8.2	5.6	0.9	5.0	6.2	0.0	8.4	11,939
Vietnam	0.7	0.3	0.3	1.0	0.2	1.0	5.2	0.9	4.4	6.2	4.1	6.3	3.7	1.2	2.7	4.9	2.1	5.0	5.2	0.9	4.4	6.1	4.0	6.2	14
World	**0.4**	**0.2**	**0.3**	**0.5**	**0.0**	**1.0**	**4.5**	**1.2**	**3.7**	**5.2**	**-2**	**8.2**	**5.6**	**0.9**	**5**	**6.2**	**0.1**	**8.6**	**5.5**	**0.9**	**4.9**	**6.2**	**-0.0**	**8.4**	**29,488**

Table 11 Baseline Regression with Control on Board Nationality Diversity

This table reports the results of the baseline regression with additional board nationality diversity control variable. The dependent variables are corporate carbon emission levels (total emission, direct emission, and indirect emission) measured by Log_carbon_total, Log_carbon_direct, and Log_carbon_indirect, respectively. The main variable of interest is nationality diversity, representing the proportion of diverse TMT nationalities scaled by TMT size. The t-statistics (in parentheses) are based on firm-level robust standard errors. The table also presents the number of observations and R^2 values for each regression. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Details of each variable are defined in the Appendix.

VARIABLES	(1) Log_carbon_total	(2) Log_carbon_direct	(3) Log_carbon_indirect	(4) Log_carbon_total	(5) Log_carbon_direct	(6) Log_carbon_indirect	(7) Log_carbon_total	(8) Log_carbon_direct	(9) Log_carbon_indirect
Nationality diversity	**-0.0950***	**-0.0796***	**-0.0335**	**-0.0922***	**-0.0821***	**-0.0335**	**-0.0922***	**-0.0821***	**-0.0335**
	(-2.811)	**(-2.645)**	**(-2.329)**	**(-2.781)**	**(-2.784)**	**(-2.382)**	**(-2.773)**	**(-2.776)**	**(-2.375)**
Log_asset	1.659***	0.648***	0.720***	1.677***	0.659***	0.730***	1.677***	0.659***	0.730***
	(22.61)	(13.85)	(22.72)	(22.28)	(13.62)	(22.44)	(22.22)	(13.58)	(22.37)
Log_BM	-0.139***	-0.0224	-0.0661***	-0.157***	-0.0287	-0.0748***	-0.157***	-0.0287	-0.0748***
	(-3.775)	(-0.892)	(-4.115)	(-3.919)	(-1.035)	(-4.306)	(-3.907)	(-1.032)	(-4.294)
PPE	0.422***	0.279**	0.170**	0.434**	0.249*	0.179**	0.434**	0.249*	0.179**
	(2.642)	(2.378)	(2.504)	(2.544)	(1.971)	(2.571)	(2.536)	(1.965)	(2.563)
Lev	0.0619	0.0178	0.0258	0.0541	0.0365	0.0213	0.0541	0.0365	0.0213
	(1.037)	(0.404)	(1.001)	(0.865)	(0.816)	(0.794)	(0.863)	(0.814)	(0.791)
ROA	0.356***	0.0998	0.172***	0.321***	0.102	0.151***	0.321***	0.102	0.151***
	(3.097)	(1.356)	(3.565)	(2.691)	(1.346)	(2.990)	(2.683)	(1.342)	(2.982)
Board Nationality Diversity	0.0435	0.0118	0.0222	0.0307	0.00425	0.0170	0.0307	0.00425	0.0170
	(1.162)	(0.375)	(1.334)	(0.895)	(0.136)	(1.125)	(0.892)	(0.135)	(1.122)
Constant	1.815***	0.216	0.710***	1.441***	-0.0172	0.528**	1.441***	-0.0172	0.528**
	(3.704)	(0.694)	(3.362)	(2.751)	(-0.0511)	(2.337)	(2.743)	(-0.0510)	(2.330)
Observations	12,644	12,644	12,644	11,762	11,762	11,762	11,762	11,762	11,762
R-squared	0.419	0.118	0.433	0.984	0.957	0.983	0.984	0.957	0.983
# of firm	2,921	2,921	2,921	2,763	2,763	2,763	2,763	2,763	2,763
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	NO	NO	NO	NO	NO	NO
Industry*TimeFE	NO	NO	NO	YES	YES	YES	YES	YES	YES
Country FE	NO	NO	NO	NO	NO	NO	YES	YES	YES

Table 12 Source of Variation

This table presents the regression result examining the relationship between TMT nationality diversity and the percentage of TMT members originating from countries ranked within the top 20 of EPI. Column 1 includes control variables, firm fixed effects, and time fixed effects. Column 2 adds industry and country fixed effects, in addition to the specifications in Column 1. The t-statistics (in parentheses) are based on firm-level robust standard errors. The table also presents the number of observations and R^2 values for each regression. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The detail of each individual variable is defined in the Appendix.

VARIABLES	(1) Perc_top_EPI	(2) Perc_top_EPI
Nationality diversity	**0.0635***** (4.248)	**0.0630***** (4.230)
Constant	0.176*** (3.060)	0.171*** (2.873)
Observations	29,538	29,538
R-squared	0.014	0.021
Controls	YES	YES
Firm FE	YES	YES
Year FE	YES	YES
Country FE	NO	YES
Industry FE	NO	YES

Table 13 The effect of variation in firm country to corporate carbon emissions

This table presents the subsample regression result examining the variation in firm country affecting the relationship between TMT nationality diversity and corporate carbon emissions. Control variables, firm fixed effects, and time fixed effects are included in all specifications. The t-statistics (in parentheses) are based on firm-level robust standard errors. The table also presents the number of observations and R^2 values for each regression. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The detail of each individual variable is defined in the Appendix.

VARIABLES	Top countries in environmental standard[1/]			The rest of the world		
	Log_carbon_ total	Log_carbon _direct	Log_carbon _indirect	Log_carbon _total	Log_carbon _direct	Log_carbon_ indirect
Nationality diversity	-0.00713	0.000565	-0.0167	-0.0292***	-0.0473**	-0.0235**
	(-0.271)	(0.0104)	(-0.632)	(-2.765)	(-2.033)	(-2.273)
Log_asset	0.695***	0.600***	0.710***	0.750***	0.646***	0.755***
	(12.71)	(7.103)	(13.09)	(35.59)	(19.85)	(35.22)
Log_BM	-0.159***	-0.102	-0.182***	-0.0569***	-0.0450**	-0.0634***
	(-3.831)	(-1.436)	(-4.522)	(-5.517)	(-2.526)	(-6.116)
PPE	0.0237	-0.0299	0.0617	0.143***	0.218***	0.122**
	(0.219)	(-0.150)	(0.565)	(2.871)	(2.784)	(2.369)
Lev	0.0431	0.0504	0.0270	-0.0215*	-0.0370**	-0.0221*
	(0.850)	(0.623)	(0.519)	(-1.923)	(-2.185)	(-1.958)
ROA	0.0835	0.0844	0.0906	0.256***	0.226***	0.270***
	(0.740)	(0.558)	(0.850)	(7.217)	(4.367)	(7.512)
Constant	0.998***	0.599	0.816**	0.616***	0.255	0.503***
	(2.979)	(1.170)	(2.453)	(4.422)	(1.180)	(3.547)
Observations	2,681	2,681	2,681	26,807	26,807	26,807
R-squared	0.413	0.130	0.426	0.484	0.122	0.495
Controls	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

[1/]Countries in the EU known for high environmental performance, such as Norway, Sweden, Austria, Denmark, Finland, and Luxembourg,