Carbon disclosure project: Chinese chief executive officer background and corporate voluntary climate change reporting

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ABSTRACT

Despite recent voluntary climate change reporting (VCCR) initiatives, such as the Carbon Disclosure Project (CDP), Chinese companies continue to lag behind their global counterparts. This research contributes to the existing literature examining the effects of CEO background (specifically academic, foreign and political background) on corporate decisions to engage in VCCR. The data sample consists of Chinese listed companies that participated in CDP surveys during 2010–2017 (1041 final firm-year observations). The study’s descriptive findings reveal that most Chinese companies are reluctant to report their climate change information to the CDP as only 12% of Chinese companies participated in the CDP annual survey during the study period. However, using a logistic regression model, we find that CEOs with academic experience, foreign exposure and political connections positively affect firms’ decisions to engage in VCCR. The results remain robust when we use the propensity score matching technique to account for sample selection problems. Overall, the results are interpreted within the theoretical insights of the upper echelons perspective.

KEYWORDS

Climate change; China; regulations; CEO background; environmental reporting

Introduction

Climate change is one of the most pressing ecological challenges confronting society in the twenty-first century. In this regard, business corporations play a crucial role in addressing this issue and supporting society in making the transition to a low-carbon future. In particular, businesses are under immense pressure from stakeholders to mitigate climate change effects [1]. Consequently, the role of corporate executives has been transformed as strategic managers to develop climate change management strategies [2]. In doing so, many companies have developed climate change reporting mechanism to communicate information about carbon emission, its management and steps implemented by the companies [3]. However, the reporting of climate change information is voluntary, and no uniform standard exists to enhance the credibility and comparability of disclosures [1]. The Carbon Disclosure Project (CDP) provides companies with an opportunity to report on their climate change information in a systematic manner. It has become a globally recognized instrument for the carbon reporting of firms [4].

CDP is a non-profit organization established in 2000 to collect climate change-related information from companies worldwide on behalf of institutional investors. Currently, CDP is managing assets of approximately 870 million dollars in value, which are owned by over 650 institutional investors [5]. CDP participation has improved globally and became a global instrument for climate change reporting [6]. However, China plays a significant role in global climate change owing to its largest energy production and consumption [7]. Chinese companies are not proactive in terms of mitigating climate change impacts [8]. With regard to CDP participation, a reasonable gap exists between China and the rest of the world. Furthermore, the quality and quantity of climate change disclosure by Chinese companies is questionable [8]. For example, many Chinese companies do not disclose quantitative environmental information [9]. One assumption is that differences in corporate responses to climate change may exist because of various internal and external factors.
A plethora of research has empirically examined the factors determining corporate voluntary climate change reporting (VCCR). For instance, studies have investigated the effect of macro-level factors, including the political and regulatory environment of the country [10–12], firm-level characteristics [13–17] and board structures [18–21], on VCCR. These studies have applied variety of theories to conceptualize the concept of VCCR. For example, legitimacy framework holds that firms should publish the bare minimum of information to meet social and environmental expectations [22]. Stakeholders’ theory posits that management’s multi-accountability to multiple stakeholders with competing interests explains VCCR [20]. Institutional theory argues that firm’s practices homogenize overtime owing to “coercive isomorphism,” mimetic processes” and “normative pressures” [23]. No single theoretical perspective offers a definitive answer to the cause of determining VCCR. These theories explain firms’ choices based on their legitimate actions, societal norms and institutional pressures. Hence, no studies have used individual-level context to explain the reasons to determine VCCR [24].

The extant literature offers valuable insights but suffers from certain shortcomings. Firstly, to the best of the authors’ knowledge, none of the prior research has explored the role of CEO background attributes in making VCCR decisions (CDP participation decision). Few studies have examined the effect of CEO characteristics on firm social and environmental performance/disclosure [25–28]. Our study differs from them in two ways. For one, our research focuses on the CEO background characteristics, i.e. academic, foreign and political backgrounds, which have not been examined in past studies (e.g. Lewis et al. [25]). In addition, prior studies have focused on the impact of different characteristics of CEOs on corporate social and environment-related performance [26, 27]. By contrast, our study concentrates on VCCR, which facilitates companies’ internal and external partners to make an informed judgment and improves firms’ potential to cope with risk and sustain competitive advantages in the long run [29].

Secondly, most of the prior studies related to the predictors of VCCR have based their theoretical foundation on legitimacy [30–32] and stakeholder theories [14, 33–35]. Our study intends to provide new insight from the upper echelons perspective [36] to understand the influence of corporate executives on corporate decisions regarding VCCR. Compared with other executives on top management teams, CEOs tend to significantly impact corporate strategic decision making [37]. According to the upper echelon framework [36, 38], CEO background attributes are essential predictors of the firm strategic decision-making process. Concerning climate change reporting, CEO background attributes help companies make VCCR decisions.

Thirdly, most studies have tended to ignore the potential effect of self-selection bias in their analysis [10, 18, 19, 22, 39]. This problem arises due to the significant differences between the characteristics of firms engaging in and not engaging in VCCR [40]. This study controls the effect of unobserved selection biases on our main regression model using the PSM approach.

The current research aims to fill the above-mentioned research gap. The study’s main goal is to determine how managerial characteristics affect corporate strategic responses to climate change. We posit that the attributes of CEOs are of significant value to tackle different environmental pressures, especially how and when particular types of environmental concerns should be addressed [25]. For example, many companies respond to climate change issues by disclosing relevant information through voluntary means of communicating their environmental performance [41]. However, a trade-off exists between disclosure and nondisclosure, creating uncertainty about the costs and benefits of climate change reporting [3, 42]. Thus, the disclosure decision becomes a tricky aspect of managers’ interpretation and assessment of the scenario [43]. The evaluations and interpretations of managers depend on their personality attributes [36]. Hence, we propose that a CEO’s background characteristics enable us to understand whether climate change disclosure is considered an opportunity or a threat [25].

This study contributes to the existing body of knowledge in various ways. Firstly, we empirically investigate the effect of CEO background on the likelihood of VCCR in the Chinese context. In particular, this study provides evidence that competent executives, i.e. CEOs with academic or research backgrounds, foreign jobs or work experience and political connections, tend to influence Chinese firms to participate in sustainable initiatives (i.e. CDP participation). Drawing theoretical foundations from the upper echelon perspective [36, 38], this research identifies that CEO background attributes are the key determinants of VCCD in China. Secondly, this study extends
previous scholars’ work that has employed CDP China data as a proxy for VCCD [8, 9]. Their research used CDP data for the top 100 companies as identified under CDP China reports each year. By contrast, this study employs a comprehensive CDP China dataset for eight years. We obtain the list of all Chinese companies produced by the CDP website (from 2010 to 2017), which enables us to provide comprehensive longitudinal analysis. Lastly, our study is among the first ones examining the determinants of VCCD to use the propensity score matching (PSM) approach to control for selection bias [10, 22, 39]. Overall, this research provides empirical evidence for Chinese CEOs to realize the significance of climate change and integrate sustainable decisions into business strategy. Furthermore, we affirmatively respond to the argument that an effective sustainable and environmental strategy integrates economic and sustainable objectives. That the corporation’s “CEO must be its chief environmental officer” is of great importance [29, p. 98].

The remainder of the study is structured as follows. The following section highlights the environmental regulations in China. Section 3 provides details on the prior literature related to the determinants of VCCD, the theoretical insights and the hypothesis development. Section 4 discusses the research methodology regarding the basic model and selection model. Section 5 presents the empirical interpretation of the results, and section 6 concludes the paper.

Background

The Chinese institutional environment is still mainly defined by authoritarian capitalism, in which the Chinese central government, local governments and the Chinese Communist Party play more than just regulatory roles in the Chinese business system. Recently, the government has been instrumental in supporting environmental reforms, owing to the enormous environmental deterioration that has resulted from the country’s rapid economic growth [45]. The trend of more effective regulations of climate change reporting in China is growing. The first set of efforts in this area was undertaken in 1998 when Green Watch, in collaboration with the State Environment Protection Administration (SEPA) of China, a group of academicians and the media launched an environmental disclosure and performance rating program [46]. In 2003, the SEPA adopted a strategic plan to promote the voluntary publication of social and environmental reports and released a series of guidelines in 2006.1 In 2007, the SEPA issued the Measures for Disclosure of Environmental Information (MDEI), a collection of guidelines symbolizing the recognition of environmental reporting as a modern mechanism of environmental governance. Then, in 2008, the Shanghai Stock Exchange (SSE) issued guidelines on environmental information reporting for listed companies. The SSE requires firms in polluting industries (as identified by the MDEI) to report nine disclosure items. In a similar vein, a draft of the Environmental Disclosure of Listed Companies Guide, which requires companies to publish environmental reports, was issued by SSE in 2010 [9]. A further significant development was made in 2014 when the Environmental Protection Law of China was introduced (enacted at the beginning of 2015), making corporate environmental disclosure publicly available. However, these environmental regulations in China only require environmental disclosure from selective industrial firms (i.e. firms in polluting sectors), constituting a small portion of all listed companies. The disclosure of climate change information is mainly voluntary disclosure in China [8].

No standard structure for carbon reporting exists, so many corporations use CDP as a tool to disclose their climate change information. Similarly, the first CDP survey questionnaire was sent to the largest Chinese companies (based on market capitalization) in 2009. In general, the CDP participation rate of Chinese companies has increased since the first survey (i.e. 5% to 58%) [47]. However, the growth rate still fell behind that of firms in developed countries. Furthermore, the factors driving companies’ voluntary CDP involvement are not well understood. Li et al. [8] conducted the only examination of the underlying motivations of Chinese corporations’ CDP participation. The findings highlight the major significance of company awareness of climate change as well as the negative effects of costs and state ownership. They also argue that CEOs’ personal benefits make it difficult for firms to participate in the CDP yearly survey.

The results of the survey reveal that the majority of Chinese companies tend to respond by providing qualitative information rather than quantitative CDP disclosures. Additionally, Chinese firms’ CDP disclosure quality is not yet definite [9]. In general, Chinese companies need to realize the significance
of global climate change as the economic benefits of corporations may not be achieved without achieving a low-carbon economy [8].

Theory, literature and hypothesis

Theoretical perspective

Many theories have been proposed to explain the factors that influence VCCR in the literature. According to the legitimacy perspective, if business actions do not conform to social standards or values, the company’s legitimacy cannot be assured, and survival and development would be difficult [48]. Some academics argued that companies should just disclose minimum information to meet social and environmental expectations [22]. To the contrary, stakeholder theory argues that VCCR is a method to deals with the expectations of multiple stakeholders [20]. Therefore, the pressure from shareholders, creditors and other individuals or groups is reflected in stakeholder theory, whereas the pressure from all social norms is reflected in legitimacy theory. Institutional theory has been used as well. Institutional perspective holds that external institutional pressures prompt companies to gradually align their business activities to satisfy social and institutional requirements [23].

Evidently, correlations have been observed among different theories. Stakeholder and legitimacy frameworks complement each other. The fundamental reason for strengthening a company’s legitimacy is to deal with stakeholder pressure. Institutional and legitimacy theories present an individual and collective viewpoint of similar aspect, respectively. However, none of the studies have used individual-level context to explain why corporations determine their VCCR based on these theories, which explain their decisions based on legitimate acts, social norms and institutional pressures [24].

According to the upper echelons framework, “if we want to understand why organizations do the things they do, we must consider the biases and dispositions of their most powerful actors — their top executives” [26, p. 334]. The theory further adds that strategic choice is limited to top executives’ bounded rationality [36], bringing different organizational outcomes. Upper echelons theory highlights important observable (e.g. age, gender, past experiences, educational track and socioeconomic status, among others) and unobservable characteristics of top executives for strategic decision making. As top executives’ past experiences form their cognition, their psychological and non-psychological characteristics are indicators of their cognitive biases and values.

From the upper echelons perspective, CEOs, as the top executive of the firms, make strategic decisions in their corporations’ best interest. This is particularly true when climate change issues become the topic of discussion. We believe that CEOs have the ability to perceive climate change challenges and align organizational strategic goals with them. CEOs are supposed to make sustainable decisions while establishing climate change strategies. Among these strategies, climate change disclosure decisions through sustainability reports, company websites or other sustainable initiatives (i.e. CDP survey participation) are crucial.

We argue that the presence of competent CEOs enables firms to adopt climate change initiatives voluntarily. Prior studies have supported that distinctive CEO background characteristics enhance the tendency of firms to engage in sustainability reporting [25, 27], which represents responsible corporate behavior towards the environment [49]. This study contends that CEOs with an academic background, international exposure and political connections are likely to enhance their sustainable corporate image by adopting pro-climate change actions such as VCCR. VCCR is one of the initiatives that firms adopt when facing climate change problems, and CEOs have the managerial discretion to take such actions.

Literature and hypothesis

The upper echelons perspective suggests that top executives’ background traits are crucial for a company’s strategic management and policy creation which leads to long-term financial progress [36]. Moreover, financial and non-financial outcomes may be improved for organizations with top executives that have gained benchmark qualities required for effective implementation of institutional standards. Therefore, background attributes of executives are crucial for the effective implementation of climate change regulations and maintain legitimacy.

The provision of climate change information in corporate sustainability reports has become a significant feature, regardless of the sector in which firms operate. The failure to disclose climate change information in nonfinancial reports places companies at a strategic disadvantage [50]. In
particular, Christensen et al. [51] postulated that top executives influence corporate strategic decisions, and firms’ choices reflect leaders’ personality traits and values. Likewise, from the viewpoint of the upper echelons framework, the top executives’ attributes are essential for effective performance and strategic decision making [38]. Based on the above discussion, we empirically evaluate the impact of the academic, foreign and political backgrounds of CEOs on the strategic decision of VCCR in China.

**Academic background**

Academic background is dissimilar to other observable attributes of top managers, such as education level [52]. The level of education shows the development of managers’ personal skills and knowledge, whereas academic background falls under the category of professional experience [53]. Academic experience is also an important variable being investigated in terms of the credentials of top management members and C-suit executives. Academicians are not only good communicators but also have the ability to think critically based on their independent evaluation approach. As a result, they are not influenced by others in the decision-making process [54]. In addition, individuals with academic experience possess high levels of professional and ethical standards. Top managers with academic experience are supposed to use their knowledge and strategic thinking and to apply their ethical standards to corporate decision making [52].

Theoretically, we contend that CEOs with an academic background are likely to hold appropriate information and knowledge to understand the long-term positive implications of corporate climate change actions. Besides, the academic experience of CEOs enhances their climate change awareness, which enables them to take sustainable actions. Such companies are willing to report their climate change information, which not only helps maintain legitimacy but also enhances corporate reputation in society [55].

Empirically, studies have investigated the influence of executives’ academic or research background on corporate sustainable performance and reporting. For instance, Lewis et al. [25] find that companies with CEOs with MBA degrees are more likely to engage in environmental disclosure. Shahab et al. [27] documented that CEOs research background positively influence corporate sustainable performance and reporting. Similarly, Ma et al. [56] found that top executives with management degrees positively affect corporate environmental information disclosure. In another investigation, Ma et al. [52] investigated the effect of top executives’ academic background on corporate social reporting in China. They further state that corporate executives with academic qualifications perceive nonfinancial reporting as an opportunity rather than a threat. The empirical findings clearly reveal that academicians as corporate executives influence social and environmental reporting. Hence, we believe that CEOs with academic backgrounds are more likely to regard climate change issues as external opportunities and would therefore use VCCR as a communication tool to take advantage of this external opportunity.

**H1. CEOs with academic backgrounds have a positive impact on VCCR.**

**Foreign background**

China’s growing number of international students outnumbers the global trend, which has been studied for its impact in many studies [57]. Nevertheless, the Chinese government has made major efforts and established policies to tempt international talent to return to China by offering incentives to lure them back to China [58]. For example, the Chinese government’s “Thousand Talents Plan,” announced in 2008, intends to attract international talent in order to foster entrepreneurship, the incorporation of innovative ideas, scholastic and industry-based research [27]. Consequently, a growing number of highly qualified individuals with overseas experience have returned to China in recent decades and are now serving as senior managers in huge corporations [59]. These returnee managers, as opposed to those who have never worked abroad, are expected offer a wealth of managerial experience, a global outlook and a network of contacts.

Theoretically, CEOs who have worked abroad and are familiar with global business culture will help companies to implement higher standards of environmental management practices [27]. We further argue that CEOs with experience in international organizations are more likely to match corporate climate change policies with international best practices, resulting in both financial and nonfinancial outcomes [60]. Moreover, the Chinese government’s “Thousand Talent Plan” can enable businesses to hire individuals with foreign
experience who will contribute towards environmentally sustainable future for corporations [61].

Few studies have examined the influence of top executive’s foreign experience on corporate social and environmental performance/reporting. Slater [62] reported that international experience of CEOs positively influence social performance. Lau et al. [63] also found that top executives’ foreign exposure has positive impact on social performance. On the contrary, Cole et al. [64] suggested that international exposure of corporate management decision makers’ enhances environmental performance. The findings of Shahab et al. [27] present a mixed result of environmental performance and reporting. They found that CEOs foreign experience is positively associated with environmental performance but not with environmental reporting. Hence, the impact of CEOs foreign background on environmental or specifically VCCR is unknown. Based on the above discussion, we believe that companies with CEOs with international experience are more likely to report climate change information.

H2. CEOs with foreign backgrounds have a positive impact on VCCR.

Political background

The political connections of top executives or board members are among the distinct features of Chinese corporations. Marquis and Qian [65] identified two main categories of political connections. The first category is corporate board members or top executives that are connected with legislative bodies in China. The second category is if any of the top managers or board members have held or are currently working in government offices in China. Related studies have claimed that both types of political connections have “symbolic” and “material” benefits [66, 67]. For example, political connections help firms build a “green image” for a corporation [68] by being environmentally responsible [69]. In addition, the socially and environmentally responsible behavior of politically connected firms is often rewarded with a high leverage of financial and nonfinancial resources, which enhances firms’ financial performance [70].

Relevant studies have shown that corporate socially and environmentally responsible behavior is associated with the political connections of top executives. For example, Gu et al. [71] found that politically connected companies are more likely to adopt socially responsible policies, in particular, ecological and charitable activities. Zhang [69] affirmed that companies with politically linked CEOs are more environmentally conscious than firms without political ties. Furthermore, Cheng [68] claimed that firms with political connections tend to publish environmental reports to build a good public image. They concluded that executives’ political connections aid companies in environmental reporting, which also helps top managers achieve personal goals in terms of promotion. Similarly, scholars argued that CEOs with political and social networks may have access to valuable information regarding environmental policies that assist them in making strategic decisions regarding climate change (such as VCCR) [72]. Furthermore, we argue that CEOs with political backgrounds are perceived to have high moral and ethical standards that motivate them to take environmentally responsible, such as VCCR.

H3. CEOs with political backgrounds have a positive impact on VCCR.

Methods

Sample and data

The sample of the study consists of Chinese companies participating in the CDP annual survey during 2010–2017. The list of Chinese corporate participants was extracted from the CDP website (CDP, 2019). We initiated our sample in 2010 because the CDP website produces historical records starting in that year. Besides, environmental performance data were collected from the environmental ratings provided by Rankins ratings China, which has been widely employed in the environmental sustainability literature [27, 73]. Furthermore, the data related to the CEO’s background, financial variables and other governance factors were extracted from the China Stock Market and Research database. The final sample of the study is 1041 observations. The sample selection criteria are presented in Table 1.

Variables

Dependent variable

We used CDP response as a proxy for a firm decision to engage in VCCR. The CDP conducts an
annual survey based on the sample of targeted companies every year. The participation of companies in this survey is voluntary. The response status of each company varies (i.e. submitted, answered questionnaire, decline to participate, etc.) Following Stanny and Ely [22] and Ben-Amar et al. [39], we employed a dummy variable approach to proxy for a firm’s decision to engage in VCCR. If a firm responds to the CDP questionnaire, the binary variable takes a value of “1” (the status is either submitted, participated or responded); “0,” otherwise.

**Independent variables**

In line with Shahab et al. [27], we used a dummy variable to determine the academic background of CEOs. The variable takes a value of “1” if the CEO has academic professional experience; “0,” otherwise. In addition, for foreign background, we used a scale variable approach that takes a value of “1” if the CEO has international working experience and an educational degree from outside China, a value of “2” if the CEO has both international working experience and an educational degree from outside China; “0,” otherwise (range 0–2). Lastly, CEO political connections are measured using an operationalized definition of Marquis and Qian [65]. The variable takes the value “1” if the CEO has worked with government bodies, e.g. the NPC and CPPCC; “0,” otherwise.

**Control variables**

We controlled for the various non-governance and governance-related factors that could affect the likelihood of VCCR (see Table 2 for definitions). Firstly, we controlled for the effect of firm-level environmental performance (ENV_P). Owing to the inconsistent effect of environmental performance on firm VCCR [16], we expected a significant relationship between the two variables. We also controlled for firm characteristics, such as firm size, leverage, profitability and the market value of the firm. Considering enormous media pressure and cost benefits, available large companies are more likely to disclose climate change information [22]. In this vein, we expected a positive association between firm size (FSIZE) and VCCR. Moreover, we controlled for firm leverage (LEVG) and profitability (ROA) with expectation of negative and positive association with VCCR, respectively. Lastly, among the non-governance factors, we controlled for the market value of the firm (MVF).

We controlled for the effect of corporate board structures (board size, board independence and the duality of the CEO). Firstly, a firm with a larger board size tends to disclose climate change information voluntarily; hence, a positive association is expected. In addition, board independence (BD_IND) is expected to enhance the tendency of VCCR. Similarly, we expected a positive association between BD_IND and VCCR. We also added CEO duality (CEOD) to control for the potential effect of

**Table 2** The operational definitions of all variables used in the study.

| Variables                        | Symbol | Definitions                                                                 |
|----------------------------------|--------|-----------------------------------------------------------------------------|
| **Dependent variable**           |        |                                                                             |
| Voluntary climate change reporting | VCCR   | A dummy variable which is equal to “1” if firm submitted or respond to the CDP questionnaire and “0” otherwise. |
| **Independent variables**        |        |                                                                             |
| Academic background              | ACDB   | A dummy variable that is equal to “1” if the CEO has an academic or research background and “0” otherwise. |
| Foreign background               | FORB   | A scale variable represents value “1” if the CEO either worked or studied outside china, while value “2” is assigned if the CEO has both worked and studied outside China and “0” otherwise. |
| Political background             | POLB   | A dummy variable which is equal to “1” if the CEO has worked with government bodies of China (e.g. CCP, State council of PRC, NPC) and “0” otherwise. |
| **Control variables**            |        |                                                                             |
| Environmental performance        | ENVP   | Corporate environmental performance is measured using RKS ratings (scaled from “0” to “100” that is, “lowest to highest rating”) to measure the environmental performance of Chinese listed firms. |
| Firm size                        | FSIZE  | A natural logarithm of total firm revenue at the end of each year.           |
| Firm leverage                    | LEVG   | A ratio of a firm’s total debts to the total asset at the year-end.          |
| Profitability                    | ROA    | A ratio of firm net profit to total asset the year end.                      |
| Board size                       | BDSZ   | A natural logarithm of a total number of directors on the corporate board.   |
| Board independence               | BIND   | A ratio of independent directors to the total director on board.             |
| Duality                          | CEOD   | A dummy variable represents value “1” if the CEO is also serving as the chairman of the board. |
| The market value of the firm     | MFV    | The natural logarithm of the market value of equity, which is calculated by the multiplication of share price and a number of outstanding shares at the end of each year. |
| Industry dummy                   | PIND   | A dummy variable represents value “1” if a firm belongs to the polluting sector identified by CSRC two-digit industrial classification standard 2012 and “0” otherwise. |

Abbreviations: CDP, Carbon Disclosure Project; CEO, Chief Executive Officer; CSRC, China’s Securities and Regulatory Commission.
agency costs. We expected a negative association between CEOD and VCCR. Lastly, based on prior studies, we expected that firms in polluting industries are more likely to respond to climate change concerns than firms in less polluting sectors. Hence, we included industry as an indicator variable that is assigned a value of “1” if a firm belongs to a polluting sector identified by the 2012 China Securities Regulatory Commission (CSRC) two-digit industrial classification code; “0,” otherwise.

**Model**

The objective of the research is to identify whether the presence of a CEO with academic, foreign and political backgrounds enhances the likelihood of VCCR. Owing to the binary nature of the dependent variable, we tested the logistic regression model using multivariate analysis. The following is the proposed empirical model:

$$
\text{Prob}(\text{VCCR}) = \beta_0 + \beta_1(\text{ACDB}) + \beta_2(\text{FORB}) + \beta_3(\text{POLB}) + \beta_4(\text{ENVP}) + \beta_5(\text{FSIZE}) + \beta_6(\text{LEVG}) + \beta_7(\text{CEOD}) + \beta_8(\text{BDSZ}) + \beta_9(\text{BIND}) + \beta_{10}(\text{CEOD}) + \beta_{11}(\text{MVF}) + \beta_{12}(\text{PIND}) + \epsilon
$$

(1)

**PSM methodology**

We employed the PSM approach to check the possible existence of false correlations that may be triggered by sample selection bias. Firstly, to construct the propensity scores, the conditional probability of the treatment (decision to respond to the CDP survey) is based on the following explanatory variables: firm size (Size, defined as the natural logarithm of total assets), return on total assets (ROA), financial analyst (AF, defined as the natural logarithm of the number of financial analysts following the company), ownership (OWN, defined as the natural logarithm of number of shares held by management) and BMR (book-to-market ratio). After obtaining the predicted value of the treatment variable from the first-step regression, we matched the two sets of samples (CDP = 1 and CDP = 0) using the caliper propensity score matching technique (caliper distance equal to 0.05 of the standard deviation of the logit regression of the propensity score). Following the above procedure, 147 (14%) poorly matched observations (firm-year) were excluded, and the remaining 894 (86%) firm-year observations were used for further analysis. We believed that the use of PSM controls the effect of other governance and non-governance characteristics on the dependent variable (CDP participation use for VCCD).

**Empirical results**

**Descriptive results**

Table 3 presents the details of the descriptive analysis of the study. The mean value of VCCR indicates that only 12% (126 observations with value = 1) of the companies respond to the CDP annual survey. The presence of CEOs with academic (ACDB), foreign (FORB) and political (POLB) backgrounds is also low at 11%, 9% and 7%, respectively. ENVP indicates significant variances across the sample as it ranges from 0 to 96. The average environmental rating score of companies is low, indicating the absence of high environmental performers from the sample of the study. Among the governance factors, BDSZ varies from 6 to 18 members on the board. The average size of the board is 10 members. The percentage of independent directors on the corporate board on average is 38%. Lastly, among the non-governance factors, the size of the companies considerably varies. The financing ability of the firms is on average 2.16%. The mean of ROA is 7%, representing the average profitability of companies. Forty-six percent of the sample firms belong to the polluting sectors, as identified by the CSRC 2012 two-digit industry classification codes.

The results of pairwise correlation among explanatory and dependent variables are reported in Appendix A. The variance inflation factors of all variables remained under the threshold limit of five [74]. Consequently, we assumed the absence of multicollinearity among variables [75]. The results show positive and significant bivariate associations between VCCR and ACDB, FORB and POLB.
| Variables | (1) VCCR | (2) VCCR | (3) VCCR | (4) VCCR |
|-----------|---------|---------|---------|---------|
| ACDB      | 0.82*** | 0.75**  |          |          |
|           | (0.30)  | (0.32)  |          |          |
| FORB      | 0.39*   | 0.47**  |          |          |
| POLB      | 1.13*** | 0.94**  |          |          |
| EnVP      | 0.01*   | 0.01*   | 0.01*   | 0.01*   |
| BDSZ      | 0.00    | 0.00    | 0.00    | 0.00    |
| BIND      | 1.94    | 1.87    | 1.84    | 1.99    |
| CEO       | 0.24    | 0.38    | 0.01    | 0.01    |
| FSIZE     | 0.04    | 0.04    | 0.04    | 0.04    |
| LEVG      | 0.07*   | 0.07*   | 0.07*   | 0.07*   |
| ROA       | 2.02    | 1.21    | 1.56    |          |
| MVF       | 0.87*** | 0.89*** | 0.90*** | 0.88*** |
| PIND      | 0.09    | 0.08    | 0.02    | 0.06    |
| Constant  | 2.95    | 2.86    | 2.84    | 2.96    |

Note. Robust standard errors in parentheses; *** p < 0.01, ** p < 0.05, * p < 0.1 and see Table 1 for variables definitions.

### Logistic regression results

Table 4 provides the results of the logistic regression used to analyze the impact of a CEO’s background characteristics on a firm’s likelihood of VCCR (CDP participation used as a proxy). We included each of the independent variables in a separate model with control variables from Models 1–3 in Table 4. In addition, to show the overall strength of the association, we included all independent and control variables in Model 4.

Model 1 of Table 4 provides evidence that the academic background of CEOs (ACDB) has a significantly positive association (β = 0.82 at p < 1%) with companies’ VCCR (VCCD) decisions. These findings are consistent with those of Shahab et al. [27]. Model 2 of Table 3 shows that the foreign background of a CEO (FORB) is also significantly positively related (β = 0.39 at p < 10%) to the likelihood of a firm’s CDP participation in VCCD. These results are contrary to the prior findings [27]. Furthermore, in Model 3, the political background of a CEO is also significantly positively associated (β = 1.13 at p < 1%) with a firm’s likelihood of disclosing climate change information through CDP participation. These results are supported by the findings of Hoover and Fafatas [12]. Model 4 shows the consistency in the results and provides evidence of the complete support for our hypotheses (H1–H3). Overall, these findings indicate that firms with competent CEOs (i.e. with academic, foreign and political backgrounds) are more likely to respond to sustainable initiatives (i.e. VCCR). Theoretically, these results agree with the upper echelon perspective [36, 38]. They corroborate that the role of the CEO’s distinct characteristics is significant for a firm’s ethical decision making, such as participating in voluntary sustainable activities (CDP participation). The response to such sustainable actions not only helps maintain corporate legitimacy but also enhances the corporate reputation among society.

Concerning the control variables, corporate environmental performance (ENVP) is positively associated with firms’ VCCD decisions (Models 1–4 of Table 4). Firms with good environmental performance tend to voluntarily disclose their environmental information in order to differentiate themselves from poor performers [43]. However, we do not find statistically significant coefficients of board-level characteristics (BDSZ, BIND and CEO), although the direction of the relationship is positive. Similarly, among firm-level characteristics, firm size (FSIZE) and ROA are positively associated but have insignificant p-values. In addition, market value has a positive effect on the likelihood of VCCD with a significant p-value. Firm leverage (LEVG) has a negative effect, and the presence of a firm in a polluting industrial sector is statistically insignificant with positive coefficients in all models.

### PSM results

As the CDP response of a firm’s decision to engage in VCCR is not random, potential bias may be related to the characteristics of the firms. To alleviate the concern that a firm’s response CDP may be fundamentally different regarding firm characteristics, we constructed a propensity score matched sample following the prior literature [42]. The PSM approach helps control the effect of possible differences in the firm characteristics of companies disclosing climate change information through CDP and those that do not respond (which is used as a proxy for the dependent variable of the study). In the first stage, we calculated the propensity scores using FSIZE (firm size), ROA (return on
Based on the caliper matching technique, the observations of the treated and control groups were matched. Propensity scores allow us to compare the treated and control group samples based on observable characteristics. Consequently, we constructed a propensity score matched sample with 893 observations.

Table 5 shows the mean difference between firms with CDP responses and the control group based on the nearest neighbor matching method, both pre- and post-matching. In the analysis of the post-matching, all variables are insignificant, indicating that firms that have and not have CDP responses are not different after using PSM. Therefore, PSM can reduce the potential sample selection bias. Furthermore, as shown in Figure 1, after PSM, the kernel density functions of the two groups are much closer, indicating that the characteristics of the variables in the two groups are similar. Overall, the results of the above diagnostic test suggest that the difference between the treated group and the control group in other observable firm characteristics is non-significant, reflecting the success of the matching.

Basing on the reduced sample after PSM, we re-estimated Models 1–4 (Table 6). We find positive coefficients for ACDB and FORB in all models, whereas POLB is partially supported. In general, we infer the robustness of the baseline results of the study. However, these findings illustrate the significance of the CEO’s competence with respect to academic, foreign and political backgrounds, which enhances sustainable corporate decisions.

### Discussion and conclusion

During the recent past, climate change reporting has received considerable attention from practitioners and academic researchers. In China, organizations have been criticized for not being proactive in responding to institutionally driven climate change regulations and guidelines issued by...
government bodies [49]. Hence, Chinese companies lack a response to voluntary climate change initiatives, i.e. participating in CDP climate change disclosure. Consequently, this research sought to address critical issues of how and why the governance structure of Chinese companies will increase the probability of engaging in climate change disclosure initiatives with an emphasis on the context characteristics of CEOs [25, 43]. The role of CEOs’ characteristics in the corporate strategic response to the climate change in terms of voluntary disclosure was the main goal of the study. The trade-off between the benefits and risks of voluntary disclosures and its dependence upon the characteristics of CEOs were also investigated. The evaluations and interpretations of managers are dependent on their personality attributes [38]. Therefore, we proposed that the academic, experiential and political background of a CEO can determine the decision of CEO regarding voluntary disclosure as to whether it is an opportunity or a threat [25].

This study used a data set of Chinese listed companies that participated in CDP surveys during 2010–2017, comprising 1041 final firm-year observations. The study’s descriptive findings demonstrate that Chinese firms’ CDP participation rate is lower than the norm set by companies in developed countries. Only 12% of the firms responded to the CDP annual survey. Among them, 11% of the CEOs have academic background, 9% have foreign experience and only 7% have political background. This may be the result of difference in institutional contexts. However, to obtain legitimacy and being competitive in international markets, Chinese companies should adopt global sustainability reporting practices [63]. For example, embracing VCCR enable firms to satisfy local and global stakeholders.

The regression results present that firms with CEOs having academic, foreign and political backgrounds enhance the probability of VCCR. Firstly, a positive association exists between CEOs academic background and VCCR decision. This finding is consistent with that of Shahab et al. [27]. In general, the presence of a CEO with sound academic background enhances the probability of publishing VCCR. Secondly, CEOs foreign background positively influence VCCR in China. This result is contrary to the prior findings [27]. The foreign experience of a CEO can influence his/her VCCR

### Table 6. PSM regression results.

| Variables   | (1) VCCR | (2) VCCR | (3) VCCR | (4) VCCR |
|-------------|----------|----------|----------|----------|
| ACDB        | 0.823*** | 0.762**  | (0.299)  | (0.314) |
| FORB        | 0.371*   | 0.462**  | (0.210)  | (0.214) |
| POLB        | 1.108*** | 0.907*** | (0.386)  | (0.406) |
| ENWP        | 0.006    | 0.000    | (0.004)  | (0.004) |
| BDSZ        | -0.005   | -0.015   | (0.042)  | (0.043) |
| BIND        | 1.323    | 1.402    | (1.854)  | (1.825) |
| CEDD        | 0.218    | 0.010    | (0.349)  | (0.397) |
| FSIZE       | -0.032   | -0.041   | (0.043)  | (0.043) |
| LEVG        | -0.056   | -0.058   | (0.039)  | (0.039) |
| ROA         | 1.538    | 0.715    | (2.177)  | (2.084) |
| MVF         | 0.789*** | 0.821*** | (0.134)  | (0.130) |
| PIN1D       | 0.128    | 0.054    | (0.256)  | (0.253) |
| Constant    | -20.858*** | -21.461*** | (3.292) | (3.169) |

**Note.** Robust standard errors in parentheses; *** p < 0.01, ** p < 0.05, * p < 0.1 and see Table 1 for variables definitions.
decision in the institutional setting of China. Thirdly, political background finds positive association with VCCR. This result is in line with the propositions of Hoover and Fafatas [12]. Theoretically, these results agree with the upper echelon perspective [36, 38]. They corroborate that the role of the CEO’s distinct characteristics is significant for a firm’s ethical decision making, such as participating in voluntary sustainable activities (CDP participation). The response to such sustainable actions not only helps maintain corporate legitimacy but also enhances the corporate reputation among society.

Overall, the findings empirically show that CEOs are realizing the importance of climate change issues and incorporating sustainable decisions into business strategies in China. Furthermore, that the chief executive officer is the company’s chief environmental officer is regarded as important for the effectiveness of a company’s sustainable and environmental strategy. Our findings provide empirical support for this recommendation.

Implications

The results of the paper have implications for policymakers and regulators. For example, Chinese corporations should assist top executives (particularly CEOs) in developing competencies and enhancing expertise, which can ensure effective implementation of the corporate climate change strategy. The “Thousand Talent Plan” is quite influential in China because different experts join organizations and contribute to the development of various strategic policies [27]. Furthermore, as environmental disclosure has become a part of corporate climate change strategy [50], policymakers should adopt different market-oriented regulatory measures to promote the environmentally sustainable corporate future. Lastly, Chinese companies should hire CEOs with political connections as they help firms fulfill financial needs and keep the corporate climate change strategy aligned with government policies. Doing so enables companies to voluntarily disclose climate change information without any risk of external regulatory pressure.

Limitations and future research

Despite some novel contributions and the robustness of the findings, this study has some limitations that open avenues for future research. Firstly, this study only looks at CEO characteristics among corporate executives; the impact of other top executives on VCCR is unknown. The effect of psychological traits on VCCR may be investigated in future studies. Secondly, our VCCR measure is a dummy variable that uses CDP participation as a proxy and only covers the likelihood of disclosure, leaving out other relevant insights into the quality of disclosure. Other research may employ a more comprehensive VCCR measure. Thirdly, this research is conducted in Chinese context, where the CDP is still in its infancy, and environmental governance is not particularly mature. Future studies may focus on firms from developed countries and compare with the results of the current study.

Notes

1. Guidelines of state-owned enterprises performing social responsibilities, the Guidelines about enhancing supervision of listed companies’ social responsibilities, the Guidelines about China’s industrial enterprises and industrial associations’ social responsibilities and the Guidelines about social responsibilities of listed companies in Shanghai Stock Exchange.

2. NPC (National People’s Congress) or CPPCC (Chinese People’s Political Consultative Conference)

Disclosure statement

No potential conflict of interest was reported by the authors.

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Data availability statement

Data set(s) associated with the manuscript will be available on request.

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### Appendix A. Correlation matrix

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-----|
| (1) VCCR  | 1.00|     |     |     |     |     |     |     |     |      |      |      |      |
| (2) ACDB  | 0.16*| 1.00|     |     |     |     |     |     |     |      |      |      |      |
| (3) FORB  | 0.09* | 0.07 | 1.00|     |     |     |     |     |     |      |      |      |      |
| (4) POLB  | 0.12* | 0.18* | -0.02 | 1.00|     |     |     |     |     |      |      |      |      |
| (5) ENV1  | 0.07  | 0.02 | 0.07 | 0.06 | 1.00|     |     |     |     |      |      |      |      |
| (6) BDSZ  | 0.08  | 0.04 | -0.04 | 0.05 | 0.01 | 1.00|     |     |     |      |      |      |      |
| (7) BIND  | 0.05  | 0.13* | 0.04 | 0.04 | 0.08 | -0.33* | 1.00|     |     |      |      |      |      |
| (8) CEOB  | 0.01  | 0.10* | -0.03 | 0.32* | -0.01 | -0.11* | 0.07 | 1.00|     |      |      |      |      |
| (9) FSIZE | 0.12* | 0.07 | 0.14* | 0.04 | 0.12* | 0.08 | 0.08* | 0.03 | 1.00|     |      |      |      |
| (10) LEVG | 0.13* | 0.14* | 0.06 | -0.00 | -0.11* | 0.40* | -0.01 | -0.07 | 0.20* | 1.00|     |      |      |
| (11) ROA  | 0.03  | -0.02 | -0.06 | 0.15* | 0.02 | -0.08* | -0.02 | 0.07 | -0.04 | -0.29* | 1.00|     |      |
| (12) MFV  | 0.24* | 0.18* | 0.07 | 0.05 | -0.05 | 0.37* | 0.04 | -0.07 | 0.25* | 0.73* | -0.15* | 1.00|      |
| (13) PIND | -0.09* | -0.11* | -0.05 | 0.06 | 0.10* | -0.20* | 0.03 | 0.07 | -0.05 | -0.32* | 0.10* | -0.32* | 1.00 |

Note. * shows significance at the 1% level and see Table 1 for variables definitions.