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Environmental performance, sustainability, governance and financial performance: Evidence from heavily polluting industries in China

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Abstract

This study seeks to contribute to the existing business strategy and the environment literature by examining the effect of governance structures on Chinese firms' environmental performance, and consequently ascertain the extent to which the financial performance–environmental performance nexus is moderated by governance mechanisms. Using a sample of Chinese companies from heavily polluting industries over a 5-year period, our baseline findings suggest that, on average, board size and governing board meetings are positively associated with Chinese firms' environmental performance, whilst board independence and gender diversity have positive, but insignificant association with firms' environmental performance. Our evidence suggests further that the examined internal governance mechanisms have a mixed moderating effect on the link between financial performance and environmental performance. Our findings have important implications for company executives, environmental activists, policy-makers, and regulators. Our results support insights drawn from agency, resource dependence, stakeholder, and legitimacy theories.

KEYWORDS
environmental management and sustainability, environmental performance, environmental pollution, financial performance, governance

1 | INTRODUCTION

China has become the second-largest economy in the world, behind the United States, and this has mainly been achieved through significant manufacturing and production of goods/services (McGuinness, Vieito, & Wang, 2017; Shahab, Ntim, & Ullah, 2019). However, such remarkable economic growth has, arguably, led to greater environmental and public health damages (Elmagrhi, Ntim, Elamer, & Zhang, 2019). For example, China is currently the world's largest consumer of energy, accounting for 23% of the total global energy consumption (Lin & Kuang, 2020). Further, and according to a report published by the US Energy Information Administration (EIA, 2019),

China is the largest producer and consumer of coal. For example, the EIA (2019) indicated that China accounted for more than 60% of global total industrial coal consumption in 2018. China is also considered as the largest contributor of carbon dioxide globally. A study conducted by researchers from Chinese University of Hong Kong indicates that air pollution emissions were estimated to cause approximately 1.1 million death and a cost of 267 billion yuan (i.e., about US $42 billion) (Kao, 2018). In response to these serious environmental, economic and social threats, the Chinese government and regulatory authorities (i.e., Ministry of Environmental Protection of China, and Shanghai, Shenzhen and Hong Kong stock exchanges) have pursued a number of positive initiatives, including introducing various laws and

guidelines that have been aimed at promoting the implementation of good environmental practices (i.e., Environmental Protection Law and Paris Agreement on Climate Change). However, and despite these different environmental reforms and measures, the lack of enforcement of laws and regulations in China has led to poor implementation of such environmental acts and guidelines (Yee, Tang, & Lo, 2016). To promote the implementation of sustainable strategies and, thus, the adoption of environmental friendly activities, it has been suggested that corporations need to strengthen their internal governance structures (De Villiers, Naiker, & Van Staden, 2011; García-Martín & Herrero, 2020), by, for example, increasing board gender diversity and independence, having appropriate board size, and instituting frequent board meetings. However, and despite the importance of internal governance structures in enhancing commitment to environmentally friendly activities (Nguyen, Ntim, & Malagila, 2020; Ntim & Soobaroyen, 2013a, 2013b), there is a lack of empirical research examining the impact of board structure variables on environmental performance among Chinese corporations, and this offers a great opportunity to make original contributions to the existing literature. Therefore, this study seeks to examine the impact of internal governance structures on the environmental performance of a sample of Chinese firms from heavily polluting industries (i.e., coal, metallurgy, mining and steel industries).

Theoretically, corporations may voluntarily commit to environmental friendly activities due to two main reasons: (i) to obtain competitive advantages, including accessing crucial resources (Allegrini & Greco, 2013; De Villiers et al., 2011; Haque & Ntim, 2020) and/or (ii) to legitimise their operations by obtaining the approval of the wider community (Al-Shaer & Zaman, 2016; Cong & Freedman, 2011; Ntim, 2016). Specifically, agency and resource dependence theories focus on the financial benefits and competitive advantages that can be obtained from adopting good governance structures, whereas legitimacy and stakeholder theories are predominately concerned with improving corporate reputation and image by adopting strong governance structures. First, agency theory suggests that good governance structures, in the form of having large, diverse and independent boards and regular meetings, can enhance managerial monitoring and improve board independence by bringing diverse views, ideas, perspectives and skills into corporate boards' decision-making thought process (Allegrini & Greco, 2013; Nelson, Gallery, & Percy, 2010), and this in turn can improve corporate environmental performance. Similarly, resource dependence theory (Hillman, Cannella, & Paetzold, 2000; Pfeffer & Salancik, 2003) indicates that good governance, which is often associated with larger, independent and diverse boards, as well as frequent board meetings, can improve corporate reputation and image by providing better connections with powerful stakeholders in order to gain access to crucial resources. Therefore, and based on agency and resource dependence theories, good governance structures can increase pressure on corporations to commit to environmentally friendly activities in order to meet the expectations of their principals and secure access to the strategic resources. On the other hand, legitimacy theory (Branco & Rodrigues, 2008; Liao, Luo, & Tang, 2015; Soobaroyen & Ntim, 2013) suggests that having large,

diverse and independent boards with frequent board meetings can increase pressure on corporations to comply with good practices in order not only to obtain competitive advantages but also to meet the values/expectations of the broader community and legitimise their activities. Finally, stakeholder theory predicts that demonstrating greater accountability and transparency via increased commitment to good environmental practices can help in improving corporate reputation/image by balancing the conflicting demands of various stakeholders (Dixon, Milton, & Woodhead, 2005; Welford, 2007). Therefore, legitimacy and stakeholder theories suggest that good governance structures are effective in protecting the interests of multiple stakeholders, and this can impact positively on corporate environmental performance.

Empirically, studies examining issues relating to environmental performance and its determinants are not only limited (Elmagrhi et al., 2019; Orazalin, 2020; Tran, Beddewela, & Ntim, 2020) but also suffer from a number of weaknesses. First, despite the importance of good governance practices and increasing suggestions that top management structures can significantly influence corporate strategic decisions, including those relating to engaging in environmentally friendly activities (Shahab et al., 2020), existing studies have focused largely on examining the effect of board structure variables on (i) governance disclosures (Elmagrhi, Ntim, & Wang, 2016; Ntim, Soobaroyen, & Broad, 2017), (ii) corporate social responsibility (Liao, Lin, & Zhang, 2018; McGuinness et al., 2017) and (iii) corporate performance (Carter, Simkins, & Simpson, 2003; Jackling & Johl, 2009). Second, studies investigating whether and how board structure variables can influence corporate environmental performance are scarce (De Villiers et al., 2011; Elmagrhi et al., 2019; García-Martín & Herrero, 2020; Rupley, Brown, & Marshall, 2012), which limit current knowledge relating to the influence of board structures on firms' environmental performance. Third, these few environmental performance studies are impaired in that they have largely been conducted in the context of developed countries, such as Australia (Rao, Tilt, & Lester, 2012), United States (De Villiers et al., 2011; Post, Rahman, & McQuillen, 2015; Rupley et al., 2012), EU (García-Martín & Herrero, 2020), Japan (Aslam, Elmagrhi, Rehman, & Ntim, 2020) and United Kingdom (Brammer & Pavelin, 2006, 2008; Liao et al., 2015), with relatively less attention being paid to environmental performance in the context of developing/emerging economies in general (Alnabsha, Abdou, Ntim, & Elamer, 2018; Haladu & Salim, 2016; Iatridis, 2013) and in China in particular, where environmental problems (i.e., land degradation, air and water pollution and deforestation) have posed significant threat to public lives and health (Elmagrhi et al., 2019; Shahab et al., 2020). Fourth, prior studies have examined the impact of a small number of board structure variables, such as board gender diversity (Ben-Amar, Chang, & McIlkenny, 2017; Harjoto, Laksmana, & Lee, 2015) and board independence (Brammer & Pavelin, 2008) on firms' environmental performance. In contrast, it seems that there is a lack of empirical studies investigating the effect of various board structure variables on environmental performance. Fifth, past empirical studies have measured firms' environmental performance in China by using either Rakins' database (Liao et al., 2018;

Shahab et al., 2020) or dummy variables (Jia & Zhang, 2011). However, such measures may not accurately capture companies' actual environmental performance (Elmagrhi et al., 2019), which raises doubt about the generalisability of the findings of these studies. As such, a content analysis technique has been used in this study to measure both the depth and scale of environmental performance among Chinese firms operating in heavily polluting industries. Therefore, these weaknesses, together, have motivated us to empirically examine the impact of various board structure variables on the environmental performance among a sample of Chinese listed companies from heavily polluting industries.[1]

Given the noticeable limitations of past environmental performance studies, our study seeks to broaden current knowledge and contribute to the existing literature in a number of ways. First, and unlike much of the prior studies that have mainly been conducted in the context of developed economies, our study advances the current knowledge by providing new evidence on governance structures and environmental performance in a country characterised by excessive industrial pollution and emissions and poor implementation of environmental laws and regulations (Chang, Li, & Lu, 2015). Second, this study contributes to the existing literature by providing evidence on the effect of board structure variables on environmental performance. More importantly, our research examines the impact of several board structure variables that have not widely been examined in past studies (i.e., board size, board gender diversity, board independence and frequency of board meetings) on the implementation of good environmental practices. Third, and distinct from past Chinese studies that included different industries in their analysis (Jia & Zhang, 2011; Liao et al., 2018; Shahab et al., 2020), our study contributes to the extant literature by focusing mainly on firms from China's heavily polluting industries that cause serious environmental and public health threats, and this, arguably, may help in reducing any sample selection bias that exists in past studies (Chang et al., 2015). Finally, and to improve the generalisability of the findings of past Chinese studies, this study employs content analysis method to develop a comprehensive environmental performance measure, covering eight dimensions.

The rest of the paper is structured as follows. The second section discusses the Chinese governance code and environmental policy in China. Section 3 presents the theoretical framework. The following sections review empirical literature and hypotheses development, present the research design and report the findings and discussion. Finally, Section 7 concludes the paper.

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[1]We focus in this study on firms from heavily polluting industries (i.e., coal, metallurgy, mining and steel industries) due to the following reasons. First, they are the largest consumers of coal in China, since coal represents about 70% of their total energy consumption (He, 2015). Second, Chinese companies from heavily polluting industries account for 8.6% of the total global emissions (Goldenberg, 2013). Third, such emissions produced by Chinese firms from heavily polluting industries can cause serious health and environmental problems (Kao, 2018). Finally, and despite the sustained and extensive governance and environmental reforms in China (i.e., Corporate Governance Codes, Environmental Protection Law, and Paris Agreement on Climate Change) that have aimed at improving firms' environmental accountability and performance (Shahab et al., 2019; Weber, 2014), environmental management, performance and sustainability still suffer from major weaknesses in China (Elmagrhi et al., 2019). These reasons, together, serve as strong motivation for us to focus on Chinese firms from heavily polluting industries.

2 | ENVIRONMENTAL POLICY, ENVIRONMENTAL MANAGEMENT AND CORPORATE GOVERNANCE IN CHINA

China has achieved rapid economic transformation and development over the past several years (i.e., China's annual growth GDP per capita is about 10%) (Worldbank, 2019) and became the world's largest manufacturing economy and exporter of goods (Shahab, Ntim, Chengang, Ullah, & Fosu, 2018; Shahab et al., 2019). China has not only become the world's largest manufacturing and exporting country, but it is also expected to become the world's most powerful economy in the coming few years (Du, Jian, Zeng, & Du, 2014). However, such remarkable economic growth has, arguably, led to greater environmental and public health damages (Elmagrhi et al., 2019). This is mainly due to fact that, in the past, the Chinese government primarily focused on boosting manufacturing and exports by not monitoring closely the massive use of environmentally harmful natural resources (e.g., coal, fossil fuel) by Chinese companies. This resulted in making China the world's most polluted country due to high carbon dioxide emissions. For example, China is one of the countries with the highest consumption of fossil energy, with coal accounting for about 70% of total energy consumption (He, 2015; Jiao, Li, & Bai, 2018; Worldbank, 2007). Further, and according to a study conducted by researchers from the Chinese University of Hong Kong, air pollution is one of the worst environmental issues in China and it causes around 1.1 million death and destroys above 20 million tons of crop production (e.g., rice and wheat) (Kao, 2018).

Due to these environmental, economic and social threats, the Chinese government and regulatory authorities have undertaken a number of positive initiatives by introducing various laws and guidelines that are aimed at promoting the implementation of good environmental practices. For example, the Chinese government imposed the first trial version of Environmental Protection in 1979 and the first official version of the same law in 1989 (Chang et al., 2015). In addition, the Chinese government issued a new updated version of Environmental Protection Law in 2014 with the aim of improving environmental governance and performance among Chinese companies (Shahab et al., 2019). Further, and since 1 May 2008, the Ministry of Environmental Protection of China (formerly known as the State Environmental Protection Administration) imposed the Regulation on Environmental Information Disclosure, which required both heavy-polluting companies and environmental agencies to publish environmental information to the general public (Du et al., 2014). The stock exchanges in China have also published guidelines on environmental disclosure for listed companies (Weber, 2014). Specifically, Shanghai, Hong Kong and Shenzhen stock exchanges have introduced various environmental protection disclosure guidelines in 2007, 2008 and 2013, requiring Chinese listed companies to publish environmental and social reports to the general public.

However, and despite these different environmental reforms and measures, the lack of enforcement of laws and regulations in China has led to poor implementation of such environmental acts and codes (Khan & Chang, 2018). Further, and despite the fact that Chinese

companies are required to produce separate environmental performance reports, the narrative and/or format of those reports are not clearly specified, and thus, environmental reporting quality can be influenced by the governing board's preferences (Jizi, 2017). Therefore, we argue that strengthening internal corporate governance structures, in the form of having large, independent and diverse boards, and frequent board meetings, can help in improving the implementations of environmental laws and guidelines. As will be explained further in the following section, prior studies (Alhossini, Ntim, & Zalata, 2021; Harjoto et al., 2015; Jensen & Meckling, 1976; McGuinness et al., 2017) suggest that establishing strong board structures can increase pressure on corporations to demonstrate greater accountability to the general public by engaging in good corporate practices, including those relating to pursing environmentally responsible strategies. This study, therefore, seeks to examine the extent to which board structure variables (i.e., board size, independence, gender diversity and frequency of meetings) can explain differences in environmental management practices among Chinese firms from heavily polluting industries.

3 | THEORETICAL LITERATURE

Agency theory (Jensen & Meckling, 1976) is based on the view that agents (directors) often act in an opportunistic manner and their actions are mainly driven by their self-interests (e.g., wealth maximisation). In this regard, establishing effective monitoring mechanisms can help in mitigating the free rider problem by scrutinising management activities (Cormier & Magnan, 2003). For instance, appointing efficient corporate boards (e.g., appropriate board size, gender diversity, independence and meeting) can play an important role in alleviating such agency problems by monitoring executive managers' decisions and actions (Fama & Jensen, 1983). This in turn could lead to a better strategic decision making, and greater transparency and disclosure practices that can lessen the extent of information asymmetry between the related parties (Jensen, 1993; Samaha, Dahawy, Hussainey, & Stapleton, 2012), and therefore positively affect corporate environmental performance. Similarly, resource dependence theory (Pfeffer & Salancik, 2003) indicates that having effective boards can help not only in mitigating agency problems but also in lowering firms' uncertainty and risks by establishing better business networks with powerful stakeholders. In this perspective, resource dependence theory implies that effective board structures can increase pressure on firms to implement good environmental polices/strategies in order to obtain the support of powerful stakeholders and thereby gain access to important resources (De Villiers et al., 2011; Hillman et al., 2000). Although agency and resource dependence theories highlight the importance of having strong governance structures in enhancing corporate environmental responsibilities and performance, these theories are impaired in that they primarily focus on the financial benefits and competitive advantages of environmental performance (Haque, 2017). However, firms may also commit to good environmental performance practices in order to improve their image and demonstrate compliance with norms/values of the larger community (Branco & Rodrigues, 2008; Dixon et al., 2005).

Accordingly, this study also employs legitimacy and stakeholder theories to explain the impact of board structure variables on firms' environmental performance. Legitimacy theory (Cong & Freedman, 2011) indicates that corporations commit to good environmental practices not only to meet the expectations of their principals but also to conform to the norms/values of the larger community. Further, legitimacy theory (Liao et al., 2015) suggests that committing to greater environmental accountability can improve corporate legitimacy and image through developing and maintaining good business connections with the external environment. In this context, firms with good governance structures are expected to have better environmental performance in order to demonstrate accountability to the wider community, as well as develop/maintain good relations with powerful stakeholders. Similarly, stakeholder theory (Al-Shaer & Zaman, 2016; Haque, 2017; Welford, 2007) indicates that good governance structures can help in addressing the conflicting interests of various groups of stakeholders, by maintaining a fair balance between the financial and nonfinancial objectives of firms. In this regard, firms may adopt good governance practices and engage in environmentally friendly activities in order to satisfy and balance the interests of various stakeholder groups. However, and despite the usefulness of both legitimacy and stakeholder theories in explaining the impact of internal governance structures on firms' environmental performance, these theories are predominately concerned with the nonfinancial benefits of environmental performance (Haque & Ntim, 2018).

The above theoretical discussions clearly illustrate that none of these theories can provide full explanation of the impact of governance structures on environmental performance alone. Therefore, we integrate agency, resource dependence, legitimacy and stakeholder theories to present more comprehensive and better understanding of the association between board structure variables and firms' environmental performance.

4 | EMPIRICAL LITERATURE AND HYPOTHESES DEVELOPMENT

In this section, we develop hypotheses based on prior studies that examine the impact of board structure variables (i.e., board size, independence, gender diversity and frequency of meeting) on firms' environmental performance and consequently ascertain whether these variables have a moderating effect on the link between financial performance and environmental performance.

4.1 | Board size and environmental performance

Board size is suggested to be an important mechanism that influences board efficiency and effectiveness (Halme & Huse, 1997; Said, Hj Zainuddin, & Haron, 2009). From legitimacy and stakeholder

theoretical perspectives (Hillman, Keim, & Luce, 2001; Prado-Lorenzo & Garcia-Sanchez, 2010), larger boards are more effective in monitoring and controlling managerial opportunistic actions, since they are often characterised by greater diversity in skills, expertise, knowledge and representation of stakeholders. Similarly, resource dependence theory (Goodstein, Gautam, & Boeker, 1994) indicates that the greater stakeholder diversity, which is often associated with larger boards, can place increased pressure on firms to commit to environmentally friendly activities, in order to develop and/or maintain better connections with the influential stakeholders and access the crucial resources. By contrast, agency theory (Eisenberg, Sundgren, & Wells, 1998; Yermack, 1996) indicates that larger boards often suffer from poor decision-making, and this is mainly due to the lack of coordination and communication among board members, and this in turn can reduce board efficiency in monitoring managerial opportunistic actions. Therefore, agency theory predicts that weak governance is tightly associated with larger boards, and this can impact adversely on firms' environmental performance.

The empirical studies have largely been conducted in the context of developed countries (De Villiers et al., 2011; Post et al., 2015; Walls, Berrone, & Phan, 2012), and the findings of these studies suggest that corporate environmental performance is positively and significantly influenced by board size. Observably, there is limited evidence on the impact of board size on corporate environmental performance in the context of emerging markets in general and in China in particular (Zou, Xie, Qi, & Yang, 2019). Particularly, using a sample of 1071 firm year observations of 362 firms in China from 2011 to 2013, Zou et al. (2019) show evidence on positive influence of board size (a control variable) on environmental performance. This lack of evidence serves as a motivation for us to examine the impact of board size on firms' environmental performance. From regulatory perspective, the Chinese Company Law (Ribeiro, Hui, & Hui, 2019) recommends that listed companies should have sufficient board size, ranging between 5 and 19 members, in order for them to operate effectively. Therefore, our first hypothesis is that

Hypothesis 1. *A positive and significant association exists between board size and environmental performance of Chinese firms from heavily polluting industries.*

4.2 | Board independence and environmental performance

Resource dependence theory (Mallin & Michelon, 2011) suggests that outside directors often provide firms with the necessary skills, talents, experience and expertise, and this in turn can help in managing firms' external dependencies by establishing better business networks with powerful stakeholders. Similarly, stakeholder theory (Haque, 2017; Liao et al., 2015) indicates that the greater diversity in skills, experience, expertise and stakeholder representation, which is often associated with independent boards, can help in addressing the conflicting interests of various groups of stakeholders, by maintaining balance between

the financial and nonfinancial objectives of firms. Further, legitimacy theory (De Villiers et al., 2011) proposes that outside directors have immaterial financial incentives to monitor and control managerial opportunistic actions and demonstrate accountability to the wider community in order to maintain and improve their reputation/image in the labour market. Therefore, and based on legitimacy, stakeholder and resource dependence theories, outside directors are expected to exert greater pressure on the executive managers to implement good environmental policies and strategies in order to demonstrate accountability to the larger community and gain access to crucial resources. Finally, agency theory (De Villiers et al., 2011; Masud, Nurunnabi, & Bae, 2018) indicates that the strong presence of outside director can help in reducing agency conflicts by increasing monitoring on the top management team's environmental investment, policy and strategy, which can impact positively on firms' environmental performance.

Empirically, prior studies have largely found positive association between board independence and environmental performance in the context of developed (Cucari, Esposito De Falco, & Orlando, 2018; Jizi, Salama, Dixon, & Stratling, 2014; Post, Rahman, & Rubow, 2011; Rao et al., 2012) and developing/emerging (Fernandes, Bornia, & Nakamura, 2019; Iatridis, 2013; Ibrahim & Hanefah, 2016) economies. In contrast, there are other strand of studies which found either a negative (Brammer & Pavelin, 2008) or no (Trireksani & Djajadikerta, 2016) association between board independence and environmental performance. For instance, Alnabsha et al. (2018) found that outside directors in Jordan had a negative influence on environmental disclosure because the appointment of independent directors heavily relies on social networks instead of individuals' competency. However, the main limitation of these studies is that they measured environmental performance indirectly using either Rakins' database or dummy which raises doubt about the generalisability of the findings of these studies. Therefore, a content analysis has been used in this study to measure both the depth and scale of environmental performance among Chinese firms from heavily polluting industries. Although past empirical studies found mixed results, the Chinese Securities Regulatory Commission (2001) and the Chinese China Association for Public Companies (2014) issued guidelines recommending that at least one third of board members should be independent directors. This implies that increasing the proportion of independent directors is seen as a positive improvement that can increase pressure on firms to implement environmentally friendly activities. Therefore, the second hypothesis of this study is that

Hypothesis 2. *A positive and significant association exists between board independence and environmental performance of Chinese firms from heavily polluting industries.*

4.3 | Board meetings and environmental performance

Theoretically, and based on agency theory (Vafeas, 1999), the number of board meeting is viewed as a good measure of board members'

diligence and efforts. It is argued that frequent board meetings can increase managerial monitoring and improve board effectiveness by allowing board members to share ideas and critically discuss issues impacting firms' operations (Laksmana, 2008; Lipton & Lorsch, 1992). Similarly, and from stakeholder and legitimacy theoretical perspectives (Hussain, Rigoni, & Orij, 2018), the increased competition, operational complexity and uncertainty in today's business environment have increased the need to have frequent meetings in order to address multiple stakeholders' concerns and better evaluate firms' various risks, including those relating to environmental challenges. Finally, resource dependence theory (Wincent, Anokhin, & Örtqvist, 2010) suggests that the increased representation of stakeholders' concerns, which is often associated with frequent board meetings, can promote corporate efficiency by developing and/or maintaining better business networks with influential stakeholders in order to access the required resources.

Empirically, there seems to be lack of empirical studies examining the effect of board meetings frequency on firms' environmental performance, and this serves as a movitation for us to examine this association. Prior studies (Garcia-Sanchez, Cuadrado-Ballesteros, & Sepulveda, 2014; Giannarakis, 2014a, 2014b; Jizi et al., 2014; Liao et al., 2018; Webb, 2004) have largely examined the impact of board frequency of meetings on corporate social responsibility and disclosure and provided mixed results. For example, Jizi et al. (2014) report a statistically positive association between social responsibility disclosures and the frequency of board meetings among US listed commercial banks. In contrast, and using a sample of 283 firms from 25 countries, Prado-Lorenzo and Garcia-Sanchez (2010) report a negative and significant relationship between the frequency of board meetings and greenhouse gas disclosures, whereas (Giannarakis, 2014a, 2014b) find no association between board frequency of meetings and social responsibility disclosures among US firms. With refernce to the impact of board frequency of meetings on environmental performance, and to the best of our knowledge, there is only one study conducted by Hussain et al. (2018) using 100 US listed firms and find insignificant association between the two variables of interests. Nevertheless, and based on the predictions of agency, legitimacy, resource dependence and stakeholders theory, we expect a positive link between board frequency of meetings and environmental performance; hence, our third hypothesis is that

Hypothesis 3. *A positive and significant association exists between board frequency of meeting and environmental performance of Chinese firms from heavily polluting industries.*

4.4 | Gender diversity and environmental performance

Board diversity is widely perceived as an important mechanism that influence leadership efficiency/effectiveness and impact on board

decisions, including those relating to corporate environmental responsibilities (Cucari et al., 2018; Liao et al., 2015; Robinson & Dechant, 1997). Prior studies suggest that board diversity can be measured using different attributes, such as gender, ethnicity, age, nationality, religion and cultural background (Haque, 2017; Mallin & Michelon, 2011; Post et al., 2011). However, the current study focuses on the gender attributes of board diversity, and this is due to the following two reasons: (i) gender diversity aspect can be objectively observed and accurately captured (Liao et al., 2015) and (ii) prior studies have widely focused on this aspect of board diversity (Elmagrhi et al., 2019; Glass, Cook, & Ingersoll, 2016; Mallin & Michelon, 2011; McGuinness et al., 2017; Nguyen, Ntim, & Malagila, 2020). Theoretically, agency theory (Hillman & Dalziel, 2003) considers increasing the proportion of female directors as an important internal monitoring mechanism that restrains managers' opportunistic behaviours, since it is often associated with promoting board independence and effectiveness by brining various aspects of relational and human capital into a corporate boardroom, which can impact positively on firms' environmental performance. Similarly, resource dependence theory (Haque, 2017) suggests that the increased representation of multiple stakeholders' interests, which is often associated with gender diverse boards, can help in addressing stakeholders' environmental concerns, which can in turn facilitate access to resources. Finally, stakeholder and legitimacy theories (Glass et al., 2016; Mallin & Michelon, 2011) indicate that female directors are more concerned about developing and strengthening their firms' relations with powerful stakeholders, and hence, they are more likely to promote strategies that address environmental challenges.

Prior empirical studies have excessively examined the extent to which board gender diversity can influence corporate social performance and disclosure (Boulouta, 2013; Cabeza-García, Fernández-Gago, & Nieto, 2018; Harjoto et al., 2015; McGuinness et al., 2017; Rao & Tilt, 2016). By contrast, studies examining whether governing board gender diversity can influence corporate environmental responsibility and disclosure are few, and the majority of these few studies have been carried out in developed countries (Cordeiro, Profumo, & Tutore, 2020; Cucari et al., 2018; Fernandes et al., 2019; Galbreath, 2010; Glass et al., 2016; Lu & Herremans, 2019; Walls et al., 2012), with the findings of these studies being mixed. However, a study conducted by Elmagrhi et al. (2019) on the Chinese A listed firms found that board gender diversity has a positive influence on corporate environmental performance. In addition, the Chinese Company Law (Ribeiro et al., 2019) suggests that Chinese firms should have gender diverse boards in order to improve board independence and competitiveness. However, it does not clearly specify the minimum number of female directors that a board should have. Thus, our fourth hypothesis is that

Hypothesis 4. *A positive and significant association exists between board gender diversity and environmental performance of Chinese firms from heavily polluting industries.*

4.5 | The moderating effect of governance structure on the financial performance–environmental performance nexus

Prior environmental and governance studies have largely focused on examining the direct link between firm's financial performance and environmental performance. However, these studies provided mixed findings, including positive (Mallin, Farag, & Ow-Yong, 2014; Prado-Lorenzo & Garcia-Sanchez, 2010), negative (Rao et al., 2012) or no (Ahmad, Peter, & Nosakhare, 2015; Brammer & Pavelin, 2008; Cormier & Magnan, 2003; Qiu, Shaukat, & Tharyan, 2016; Walls et al., 2012) relsationship between these variables of interets. A major limitation of these studies is that they fail to take into account the moderating effect of governance structures on this relationship. Theoretically, agency theory suggests that establishing good governance structures can strgenthen the link between firm's financial performance and environmental performance by aligining management interests with those of stakeholders and encourcing managers to act in stakeholders' best interests (Qiu et al., 2016). Similarly, legitimacy and stakeholder theories indicate that commiting to good governance practices can improve corporate legitimacy by indicating to the market that firms' are primarily concerned with protecting multiple stakeholders' interests (Al-Tuwaijri, Christensen, & Hughes Ii, 2004; Cormier & Magnan, 2003), and this can improve the link between firm's financial performance and environmental performance. Further, resource dependence theory proposes that strong commitment to stakeholders' expectations, in the form of implementing good governance and environmental practices, can grant competitive advantages to firms, including providing better business network with key stakeholders (Russo & Fouts, 1997), and this consequently can have positive impact on firm's environmental performance and financial performance. Empirically, and to the best of our knowledge, none of the existing enviromental studies have examined the moderating effect of governance structures on the financial–environmental performance nexus, and this offers a great opporunity to make new contribution to the extant literature. Therefore, and based on the above theoretical arguments, our final hypothesis is that

Hypothesis 5. *The link between financial performance and environmental performance is moderated by governance structures, with the financial performance–environmental performance nexus being stronger in Chinese firms @from heavily polluting industries with strong governance structures.*

5 | RESEARCH DESIGN

5.1 | Data and sampling

Our data sample includes both financial and nonfinancial information. We collected financial data from the Chinese Securities Market and Accounting Research (CSMAR) database. Nonfinancial data were gathered from annual reports or corporate social responsibility reports, which we downloaded from Cninfo website (http://www.cninfo.com.cn/new/index). It seems that Chinese heavily polluting industries are the main source of pollution in China. Our sample includes manufacturers in coal, metallurgy, mining and steel industries because these four industries have damaging effect on environment, namely, air and water pollution. We started collecting data in 2013 because of limited available environmental performance data before 2013. The financial year of 2017 was the last year for which data were available at the time of collecting data. We restricted our balance final sample to firms with full data available; this resulted in including 100 companies. Table 1 presents the total sampled companies, sample selection criteria and final sample size.

5.2 | Variables

Table 2 summarises all the main types of variables, which we used in investigating our research hypotheses.

First, this research uses *ENVIP* as the main dependent variable. Previous studies conducted in China have gathered *ENVIP* from Rankins database (Elmagrhi et al., 2019; McGuinness et al., 2017; Shahab et al., 2018) or used dummy variables (Jia & Zhang, 2011). However, these measures raise doubts about the generalizability of the findings of previous Chinese studies (Elmagrhi et al., 2019). Therefore, in order to avoid above problems, we use content analysis method approach to measure *ENVIP*, following well-established studies, such as Ntim, Lindop, and Thomas (2013) and Ntim and Soobaroyen (2013a, 2013b). We have tried our best to ensure that *ENVIP* is valid and reliable measure for environmental performance by carrying out three rounds of coding. In the first round, two independent coders coded environmental performance for an initial sample of 10 heavily polluting companies and discussed coded items and categories. In the second round, the two coders removed any duplication in the included items and corrected any inconsistencies in the coding process. In the final round of coding, following recommendations of Krippendorff (2004), a further 10 heavily polluting companies were coded by two independent coders and a new independent coder with experience of using content analysis and reading Chinese reports. No inconsistencies or mistakes were identified by the three coders, which

TABLE 1 Data sample

Heavily polluting companies	Total	Number of companies
Listed companies in coal, metallurgy, mining and steel industries	132	
Exclude:	32	
Companies in special treatment process (e.g., installation of sewage treatment plants)		*15*
Companies lack annual reports and corporate social responsibility reports		*17*
Final sample total	100	

TABLE 2 Variables definition and measurement

Name	Symbol	Definition
Dependent variable:		
Environment performance	ENVIP	Total score/optimal disclosure score.
Firm performance	FIRMP	Net profit before taxation/total assets (ROTA).
Independent variables:		
Board size	BSIZE	Natural log of number of directors sitting on the board.
Board independence	BINDE	Number of independent nonexecutive directors/number of directors sitting on the board.
Board meeting	BMEET	Natural log of number of meetings held in the year.
Gender diversity	GDIVE	Number of female directors/ number of directors sitting on the board.
Control variables:		
Firm size	FSIZE	Natural log of total assets of a firm.
Firm leverage	FLEVE	Total debt/Total assets.

implied that *ENVIP* is valid and reliable measure for environmental performance. Based on literature and coding process, *ENVIP* includes eight dimensions, namely, clarity, environmental management, environmental liabilities, environmental costs, environmental investments, environmental performance, reliability and system implementation. We assign a score to the items according to qualitative or quantitative environmental performance reporting in annual and corporate social responsibility reports of the sample firms. Specifically, a value of "2," "1," and "0" denotes "monetary information," "nonmonetary information" and "no information" of environmental performance, respectively. Furthermore, the highest score differs among each item due to the difference in quantitative information. As a result, the optimal disclosure score is 24 (see Table 3 for additional information). Total score divided by the optimal disclosure is a measure of *ENVIP*.

Second, corporate governance (*CG*) mechanisms are our main independent variables. Based on the existing literature, we measure *CG* mechanisms as follows: (i) board size (*BSIZE*) is measured by natural log of the total board members (Yermack, 1996), (ii) board independence (*BINDE*) is measured using the percentage of the independent nonexecutive directors on the board (Farag & Mallin, 2016), (iii) board meetings (*BMEET*) is measured by natural log of the number of board meetings per year (Rashid, 2018) and (iv) finally we calculate gender diversity (*GDIVE*) by using the proportion of women directors to total number of board members (Elmagrhi et al., 2019). Third, and to test H5 (moderating effect of corporate governance on the financial performance–environmental performance nexus), we created interaction variables between corporate governance mechanisms (*BSIZE*, *BINDE*, *BMEET*, *GDIVE*) and financial performance (*FIRMP*). Based on the existing literature (Brammer & Pavelin, 2008), financial performance is measured by net profit before taxation to total assets

TABLE 3 Environmental disclosure index

Dimensions	Evaluation contents	Optimal disclosure fraction (score)
Clarity	The environmental information disclosure is independent and professional in Corporate Annual Report	1
	The environmental information disclosure is independent and professional in Corporate Social Responsibility Report	1
Environmental management	Disclosure of important environmental events	1
Environmental liabilities	The company presents level of pollutant emission	2
Environmental costs	The company presents level of resource consumption	2
Environmental investments	The company presents level of environmental investment	2
	The company presents level of research and development	2
Environmental performance	The company presents level of reduction of pollutant emission	2
	The company presents level of energy saving	2
	The company presents level of achieving Green project	2
Reliability	Gaining environmental certification	1
	Gaining environmental honour	1
	Receiving Government subsidy	1

(Continues)

TABLE 3 (Continued)

Dimensions	Evaluation contents	Optimal disclosure fraction (score)
System implementation	Implementing environmental policy	1
	Following three simultaneous system (Design, Construction, Operation)	1
	Paying for sewage fees	2
Total		**24**

(ROTA). We have used this measure due to three main reasons. First, and unlike other corporate performance measures (e.g., ROE, ROIC), ROTA is considered as an effective and reliable proxy for corporate financial performance, because it "*has more distributional properties, for instance, firms' total assets are strictly positive, whereas their total equity can be zero or even negative*" (Mangena, Tauringana, & Chamisa, 2012, p. S31). Second, ROTA has widely been used by prior studies (Qiu et al., 2016; Haque &Ntim, 2018; De Villiers et al., 2011). Finally, and due to data availability, we limited our financial performance measure to ROTA.

Finally, we include firm size (FSIZE) and firm leverage (FLEVE) as control variables in order to limit possible omitted variables bias (Gujarati, 2009) due to two main reasons. First, and following the findings of previous studies (Akbas, 2014, 2016; Giannarakis, 2014a; Welbeck, Owusu, Bekoe, & Kusi, 2017), we expect FSIZE and FLEVE to have significant influence on ENVIP. Second, financial data on other variables for the heavily polluting companies, including executive pay, was not accessible on CSMAR at the time when data collection started, and thus, we restricted our controls to FSIZE and FLEVE. Therefore, and consistent with prior studies (Akbas, 2014, 2016; Giannarakis, 2014a; Maso, Basco, Bassetti, & Lattanzi, 2020; Welbeck et al., 2017), we measure FSIZE as the natural log of total assets at the

end of fiscal year, whereas FLEVE is measured as the total debt to total assets.

5.3 | Research model

Following a well-established line of research (Elmagrhi et al., 2019; Shahab et al., 2018), we use ordinary least squares regression models to investigate our hypotheses. Specifically, we estimate Equation **(1)** to test our hypotheses from hypothesis 1 to hypothesis 4:

$$ENVIP_{it} = \beta_0 + \sum_{k=1}^{4} \beta_k CG_{it} + \beta_5 FSIZE_{it} + \beta_6 FLEVE_{it} + \varepsilon_{it} \qquad (1)$$

where ENVIP: the environmental performance; CG: independent variables, including 4 corporate governance measures, which are BSIZE, BINDE, BMEET, GDIVE; FSIZE: firm size; FLEVE: firm leverage; β: the parameters for the independent variables, firm size, and firm leverage; t: year; i: firm; ε: error term; (Refer to Table 3 to get more details of variables).

Furthermore, hypothesis 5 is investigated by using the following model Equation 2:

$$ENVIP_{it} = \beta_0 + \sum_{k=1}^{4} \beta_k CG_{it} + \beta_5 FIRMP_{it} + \sum_{k=6}^{9} \beta_k CG_{it}$$
$$* FIRMP_{it} + \beta_{10} FSIZE_{it} + \beta_{11} FLEVE_{it} + \varepsilon_{it} \qquad (2)$$

where FIRMP is financial performance.

6 | EMPIRICAL RESULTS AND DISCUSSION

6.1 | Descriptive statistics

Table 4 summarizes descriptive statistics relating to ENVIP, FIRMP, corporate governance mechanisms and control variables of 100 listed Chinese heavily polluting companies (e.g., steel, mining, coal and metallurgy).

TABLE 4 Descriptive statistics

	Observation	Minimum	Maximum	Mean	Standard deviation
Dependent variable					
ENVIP (%)	500	0	70.83	22.83	13.3
Independent and moderating variables:					
BSIZE (no.)	500	5	18	9.61	2.24
BINDE (%)	500	28.57	66.67	37.38	5.00
BMEET (no.)	500	3	24	8.72	3.363
GDIVE (%)	500	0	71.43	8.66	9.92
FIRMP (%)	500	−26.4	121.03	1.55	8.13
Control variables:					
FSIZE (Yuan)	500	6700.919	238275.5	34633.37	32914.32
FLEVE (%)	500	0.78	100	52.37	22.17

See Table 2 for variable definitions.

According to Table 4, *ENVIP* ranges from a minimum of 0% to a maximum of 70.83% with average of 22.83%, which is less than the findings of some studies (Elmagrhi et al., 2019; McGuinness et al., 2017). These findings indicate that environmental performance in high polluting industries in China is quite low and companies' enthusiasm to disclosing environmental performance is not high. Overall, Chinese heavily polluting firms follow Chinese *CG* codes. For instance, the number of directors ranges from a minimum of 5 to a maximum of 18, indicating that board of directors is in line with Chinese *CG* codes, which require boards to have from 5 to 19 members (Jiang & Kim, 2015; Ribeiro et al., 2019). Boards have average of nine members, which is similar to the findings of McGuinness et al. (2017) but is less than those of Elmagrhi et al. (2019). In addition, following the requirements of organising more than two board meetings per year (Jiang & Kim, 2015; Ribeiro et al., 2019), Chinese heavily polluting companies arrange a minimum of 3 meetings and a maximum of 24 meetings, with an average of 9 meetings. Furthermore, Chinese heavily polluting firms appoint a minimum of two to a maximum of eight independent directors with an average of four outsiders. Thus, *BINDE* ranges a minimum of 28.57% to a maximum of 66.67% with an average of 37.38%, which is line with *CG* regulations (Jiang & Kim, 2015; Ribeiro et al., 2019) and the findings of McGuinness et al. (2017). Additionally, although *CG* regulations do not provide specific requirements regarding the number or the percentage of female directors, Chinese heavily polluting firms started evaluating and appointing female directors (average of 1 woman director or women directors hold 8.66% board seats), which is less than the findings of Elmagrhi et al. (2019). It seems that corporate governance practices in high polluting industries are extremely low (e.g., low appointment of women directors and independent directors). As regards to *FLEVE*, Chinese heavily polluting companies use average of 52.37% of debt, which is in line with the finding of McGuinness et al. (2017), illustrating that these firms prefer using debt to equity capital. With reference to the other variables, including *FIRMP* and *FSIZE*, all show wide variation, indicating that there is adequate variation in our variables.

Table 5 contains both Pearson's and Spearman's correlation matrices for all variables used in our study in order to identify the presence of normal distributed variables and any multicollinearity problems. The level of Pearson's correlation is similar to Spearman's one, indicating that all our variables do not appear to have any serious abnormal distributions. In addition, the levels of correlation among all variables are quite low, implying that there are no serious multicollinearity problems. Overall, the findings indicate that all our variables seem to be suitable for OLS regression.

6.2 | Multiple regression analyses

6.2.1 | The influence of corporate governance on environmental performance

Table 6 reports the results of the influence of *CG* on *ENVIP*. Specifically, Models 1 to 4 report the impact of each *CG* mechanism on *ENVIP*, while Model 5 shows the influence of the combination of all *CG* variables on providing environmental information. Model 6 presents the results of the full model.

First, Models 1, 5 and 6 show evidence of significant and positive relationship between *BSIZE* and *ENVIP*, implying that hypothesis 1 is empirically supported. Our results indicate that the larger the board size, the better the environmental performance is. The positive influence of *BSIZE* on *ENVIP* is also in line with prior studies (De Villiers et al., 2011; Post et al., 2015; Walls et al., 2012; Zou et al., 2019) and theoretical predictions that larger boards provide more information on environmental performance in order to gain crucial resources based on a good connection with powerful stakeholders (Goodstein et al., 1994). Our findings indicate that board of directors in China have a concern for not only corporate social responsibility (McGuinness et al., 2017), but also environmental performance. Our results show evidence to suggest that Chinese heavily polluting companies with larger boards tend to disclose more environmental performance information compared with their smaller counterparts.

TABLE 5 Correlation matrix

	ENVIP	**BSIZE**	**BINDE**	**BMEET**	**GDIVE**	**FIRMP**	**FSIZE**	**FLEVE**
ENVIP		0.298[*]	−0.004	0.336[*]	−0.102	−0.116	0.575[*]	0.387[*]
BSIZE	0.281[*]		−0.358[*]	0.042	−0.205[*]	−0.058	0.317[*]	0.290[*]
BINDE	−0.030	−0.420[*]		0.041	0.103	0.033	0.093	−0.097
BMEET	0.301[*]	0.006	0.022		−0.013	0.024	0.156[**]	0.132[***]
GDIVE	−0.095	−0.150[**]	0.109	−0.006		0.072	−0.218[*]	−0.074
FIRMP	−0.019	−0.055	0.048	0.021	0.071		−0.092	−0.452[*]
FSIZE	0.542[*]	0.306[*]	0.020	0.172[*]	−0.214[*]	−0.062		0.500[*]
FLEVE	0.361[*]	0.284[*]	−0.140[**]	0.108	−0.058	−0.281[*]	0.442[*]	

Note: The bottom left half of the table reports Pearson's parametric correlation coefficients, while the upper right half of the table presents Spearman's nonparametric correlation coefficients. Variables are defined as follows: ENVIP (ENVIP); Board Size (BSIZE), Board Independence (BINDE), Board Meeting (BMEET), Gender Diversity (GDIVE), Firm Size (FSIZE), Firm Leverage (FLEVE) and Financial Performance (FIRMP).
*Significant at 1% level.
**Significant at 5% level.
***Significant at 10% level (Sidak-adjusted significance level).

TABLE 6 The influence of corporate governance on environmental performance

Dep. variable	ENVIP	ENVIP	ENVIP	ENVIP	ENVIP	ENVIP
(model)	(1)	(2)	(3)	(4)	(5)	(6)
Independent variables (corporate governance):						
BSIZE	0.171 (0.000)*				0.189 (0.000)*	0.079 (0.002)*
BINDE		−0.077 (0.517)			0.277 (0.020)**	0.077 (0.474)
BMEET			0.111 (0.000)*		0.107 (0.000)*	0.080 (0.000)*
GDIVE				−0.129 (0.030)**	−0.079 (0.152)	0.025 (0.606)
Control variables:						
FSIZE						0.079 (0.000)*
FLEVE						0.072 (0.003)*
No of obs.	500	500	500	500	500	500
No of firms	100	100	100	100	100	100
Year fixed effect	Y	Y	Y	Y	Y	Y
R^2 (%)	8.44	0.25	9.36	1.11	18.48	37.04
F-test	9.11	0.25	10.21	1.11	13.91	28.76
p-value	0.000	0.941	0.000	0.352	0.000	0.000
Mean VIF	1.49	1.48	1.49	1.48	1.38	1.42
Max VIF	1.61	1.60	1.62	1.61	1.65	1.66

Note: Variables are defined as follows: ENVIP (ENVIP); Board Size (BSIZE), Board Independence (BINDE), Board Meeting (BMEET), Gender Diversity (GDIVE), Firm Size (FSIZE) and Firm Leverage (FLEVE). *p*-value is in parentheses
*Correlation is significant at 1% level.
**Correlation is significant at 5% level.
***Correlation is significant at 10% level.

Second, Models 2 and 6 report the insignificant effect of *BINDE* on *ENVIP*, whereas Model 5 shows evidence of significant and positive relationship between *BINDE* and *ENVIP*, indicating that hypothesis 2 is partly supported. Our results indicate that the presence or absence of independent directors on corporate boards has not changed corporate environmental performance. The insignificant impact of *BINDE* on *ENVIP* are inconsistent with those of previous studies (Fernandes et al., 2019; Iatridis, 2013; Ibrahim & Hanefah, 2016) and theoretical predictions that independent directors put high pressure on disclosing environmental performance. The insignificant relationship can be explained by several reasons. The first reason is related to the capacity and perspective of outside directors. Combining with the findings of McGuinness et al. (2017), it seems that independent directors in China are unable to evaluate their importance and put pressure on managers to provide information on corporate social responsibility and environmental performance. Second, similar to the findings of previous studies in the context of developing countries (Alnabsha et al., 2018; Sartawi, Hindawi, Bsoul, & Ali, A. e. J., 2014), nonexecutive directors in China may not be truly independent because they have strong connection with executive directors, which may affect their independence. Third, independent directors may have less influence on corporate managers, since the cost of solving environmental issues may be higher than transaction cost of disclosing environmental information (Galbreath, 2011). Finally, outside directors appear to have weak voice to compel companies to disclose environmental performance because of their relatively low presence on corporate boards in our sample of firms investigated.

Our findings suggest that instituting a training programme for directors in order to improve their skills will be a step in the right direction.

Third, Models 3, 5 and 6 show that *BMEET* positively relates to *ENVIP* at 1% level, indicating that hypothesis 3 is strongly supported. Our findings indicate that firms with regular board meetings tend to have better environmental performance. The positive impact of *BMEET* on *ENVIP* further supports the findings of prior studies (Jizi et al., 2014) and theoretical predictions that frequency of board meetings create good opportunities for board of directors to share ideas, work effectively to address multiple stakeholders' concerns on environment. Our results show evidence that directors in Chinese heavily polluting companies tend to focus on discussing environmental issues at board meetings.

Finally, Model 4 reports a significant and negative link between *GDIVE* and *ENVIP*, whilst both Models 5 and 6 show evidence of insignificant influence of *GDIVE* on *ENVIP*, illustrating that hypothesis 4 is rejected. These findings indicate that the increase in transaction cost of unethical behaviour (i.e., not providing environment performance) is less than the cost of solving environmental issues caused by companies (Galbreath, 2011). Hence, women directors are willing to not disclose more information on environmental performance in order to protect shareholder returns. Additionally, our results indicate that women directors have no power to affect corporate environmental performance. The insignificant relationship between *GDIVE* and *ENVIP* is contrary to previous studies (Elmagrhi et al., 2019) and theoretical predictions that women directors can help increase disclosures relating

to environmental performance because they tend to be more concerned about environmental issues compared with male directors. The insignificant impact of board gender diversity on environmental performance can be explained by some factors. First, the presence of women directors in Chinese heavily polluting companies is extremely low (less than 10%) by comparison with other sectors (Elmagrhi et al., 2019; McGuinness et al., 2017). Second, similar to the case in Italy (Cucari et al., 2018), Chinese women directors are appointed by regulatory pressures rather than necessarily based on their good expertise.

6.2.2 | The moderating role of corporate governance on the link between financial performance and environmental performance

Table 7 reports the findings of the moderating role of corporate governance on the link between financial and environmental performance. Specifically, Model 1 displays the link between FIRMP and ENVIP, whereas Model 2 reports the impact of four corporate

governance indicators and FIRMP on ENVIP. Model 3 shows the results of the full model.

According to Table 7, FIRMP affects ENVIP insignificantly and negatively. Our findings show that there is no relationship between financial performance and environmental performance. The insignificant relationship between FIRMP and ENVIP is in line with the results of previous studies (Ahmad et al., 2015; Alnabsha et al., 2018; Brammer & Pavelin, 2008; Qiu et al., 2016; Walls et al., 2012), indicating that the trade-off between financial performance and environmental performance in heavily polluting industries does not exist. Therefore, Chinese heavily polluting companies should think of reporting more environmental performance in order to improve financial performance. This is because they can increase their reputation and gain the support of influential stakeholders in order to have access to crucial resources, which can improve their financial performance.

In addition, both Models 2 and 3 report are negative and significant influence of BSIZE*FIRMP on ENVIP and insignificant effect of

TABLE 7 The moderating role of corporate governance in the financial-environmental performance nexus

Dep. Variable	ENVIP	ENVIP	ENVIP
(model)	(1)	(2)	(3)
Independent variable:			
FIRMP	−0.000 (0.647)	−0.002 (0.115)	−0.001 (0.363)
Corporate governance:			
BSIZE		0.191 (0.000)*	0.080 (0.002)*
BINDE		0.281 (0.019)**	0.069 (0.523)
BMEET		0.108 (0.000)*	0.080 (0.000)*
GDIVE		−0.086 (0.119)	0.021 (0.677)
Interaction variables:			
BSIZE * FIRM		−0.011 (0.042)**	−0.009 (0.073)***
BINDE * FIRM		−0.011 (0.654)	−0.036 (0.107)
BMEET * FIRMP		−0.001 (0.849)	−0.001 (0.623)
GDIVE * FIRMP		0.011 (0.228)	0.011 (0.140)
Control variables:			
FSIZE			0.080 (0.000)*
FLEVE			0.074 (0.004)*
No of obs.	500	500	500
No of firms	100	100	100
Year fixed effect	Y	Y	Y
R^2 (%)	0.21	19.51	37.94
F-test	0.20	9.06	19.73
p-value	0.961	0.000	0.000
Mean VIF	1.52	1.55	1.58
Max VIF	1.70	2.36	2.56

Note: Variables are defined as follows: Environmental performance (ENVIP); Board Size (BSIZE), Board Independence (BINDE), Board Meeting (BMEET), Gender Diversity (GDIVE), Firm Size (FSIZE) and Firm Leverage (FLEVE). The interaction variables created for firm performance and four CG proxies, respectively. p-value is in parentheses
*Correlation is significant at 1% level.
**Correlation is significant at 5% level.
***Correlation is significant at 10% level.

BINDE*FIRMP, *BMEET*FIRMP* and *GDIVE*FIRMP* on *ENVIP*. Our results indicate that only board size can moderate the financial performance–environmental performance nexus, while board meetings, independence and gender diversity do not appear to have any effect on this relationship, implying that hypothesis 5 is partly rejected. Our results are also inconsistent with theoretical predictions that good corporate governance practices can improve the link between financial and environmental performance. The insignificant moderating role of corporate governance in the financial performance–environmental performance nexus can be explained by the weak corporate governance practices in heavily polluting firms in China. More specifically, the presence of independent directors and female directors is extremely low. Indeed, both women directors and independent directors are appointed by regulatory pressures instead of being based on their expertise.

7 | ADDITIONAL ANALYSES

Tables 8 and 9 report the results of re-estimating Equation 1 and 2 to check their robustness. Specifically, this study also conducts several additional tests, such as random effects model (*REM*) and fixed effects model (*FEM*), which can be used to analyse panel data because they allow us to control for unobservable variables (Camaron & Trivedi, 2009). Furthermore, the results of this study reported under the main analysis might be subject to potential self-selection bias if environmental performance and the corporate governance measures are endogenously determined. Therefore, any conclusions drawn from these models might be misleading. Hence, to deal with any potential endogeneity problems, this study uses a two-stage least square (*2SLS*) and a dynamic system generalised method of moment (*GMM*) estimation. Given that the focus of this study is on corporate governance and environmental performance, this study seeks to identify good exogenous instrumental variables (*IVs*) for this main variable that is correlated with the suspected endogenous variable, but uncorrelated with the error term of the dependent variable (Wooldridge, 2015). Following the findings of previous studies (Cho & Kim, 2003), we treat board independence (*BINDE*) as an endogenous variable, which is affected by firm size (*FSIZE*), firm leverage (*FLEVE*) and 2-year lag of board independence (*BINDE*). As regards Tables 8 and 9, the results of endogeneity and over identification tests indicate that these three IVs are valid for treating *BINDE* as an endogenous variable. Additionally, in accordance with *GMM* model, the values of *AR* and Hansen tests

TABLE 8 The influence of corporate governance on environmental performance, using REM, FEM, 2SLS, and GMM

	Fixed effect	Random effect	2SLS	GMM
Dep. variable	ENVIP	ENVIP	ENVIP	ENVIP
(*model*)	(1)	(2)	(3)	(4)
Lagged % ENVIP				0.279 (0.009)*
Independent variables:				
BSIZE	−0.037 (0.161)	0.002 (0.948)	0.053 (0.263)	0.042 (0.235)
BINDE	−0.060 (0.448)	−0.048 (0.535)	−0.212 (0.501)	0.149 (0.356)
BMEET	0.026 (0.011)**	0.031 (0.002)*	0.069 (0.000)*	0.054 (0.001)*
GDIVE	0.084 (0.077)***	0.066 (0.140)	0.037 (0.563)	0.038 (0.516)
Control variables:				
FSIZE	0.013 (0.446)	0.061 (0.000)*	0.083 (0.000)*	0.052 (0.000)*
FLEVE	0.031 (0.257)	0.043 (0.079)***	0.059 (0.066)***	0.057 (0.082)***
No of obs.	500	500	300	400
No of firms	100	100	100	100
Year fixed effect	Y	Y	Y	Y
R^2 (%)	14.60	34.76	32.89	
F-test *p*-value	0.015			
Wald 2 test *p*-value		0.000	0.000	
Endogeneity (*p*-value)			0.072	
Over identification (*p*-value)			0.015	
Arellano-Bond test for AR(1)				0.000
Arellano-Bond test for AR(2)				0.628
Hansen test *p*-value				0.210

Note: Variables are defined as follows: Environmental performance (ENVIP), Board Size (BSIZE), Board Independence (BINDE), Board Meeting (BMEET), Gender Diversity (GDIVE), Firm Size (FSIZE) and Firm Leverage (FLEVE). *p*-value is in parentheses
*Correlation is significant at 1% level.
**Correlation is significant at 5% level.
***Correlation is significant at 10% level.

TABLE 9 The moderating role of corporate governance in the nexus between firm performance and environmental performance, using REM, FEM, 2SLS and GMM

	Fixed effect	Random effect	2SLS	GMM
Dep. variable	ENVIP	ENVIP	ENVIP	ENVIP
(model)	(1)	(2)	(3)	(4)
Lagged % ENVIP				0.284 (0.003)*
Independent variable (firm performance):				
FIRMP	−0.000 (0.611)	−0.000 (0.536)	−0.001 (0.731)	−0.001 (0.259)
Corporate governance:				
BSIZE	−0.036 (0.176)	0.003 (0.912)	0.048 (0.316)	0.050 (0.167)
BINDE	−0.064 (0.412)	−0.054 (0.487)	−0.258 (0.421)	0.162 (0.338)
BMEET	0.026 (0.012)**	0.031 (0.002)*	0.066 (0.000)*	0.053 (0.001)*
GDIVE	0.075 (0.121)	0.057 (0.212)	0.032 (0.626)	0.020 (0.729)
Interaction variables:				
BSIZE * FIRMP	−0.004 (0.147)	−0.005 (0.089)***	−0.009 (0.154)	−0.010 (0.001)*
BINDE * FIRMP	−0.027 (0.045)**	−0.026 (0.056)***	−0.046 (0.135)	−0.037 (0.073)***
BMEET * FIRMP	0.001 (0.325)	0.001 (0.388)	−0.001 (0.808)	−0.000 (0.902)
GDIVE * FIRMP	−0.003 (0.544)	−0.004 (0.402)	0.009 (0.327)	0.009 (0.151)
Control variables:				
FSIZE	0.017 (0.318)	0.063 (0.000)*	0.082 (0.000)*	0.055 (0.001)*
FLEVE	0.024 (0.403)	0.036 (0.155)	0.070 (0.043)*	0.0480 (0.202)
No of obs.	500	500	300	400
No of firms	100	100	100	100
Year fixed effect	Y	Y	Y	Y
R^2 (%)	17.41	34.68	33.29	
F-test *p*-value	0.015			
Wald test *p*-value		0.000	0.000	
Endogeneity *(p-value)*			0.063	
Over identification *(p-value)*			0.009	
Arellano-Bond test for AR(1)				0.000
Arellano–Bond test for AR(2)				0.444
Hansen test *p*-value				0.263

Note: Variables are defined as follows: Environmental performance (ENVIP), Financial Performance (FIRMP), Board Size (BSIZE), Board Independence (BINDE), Board Meeting (BMEET), Gender Diversity (GDIVE), Firm Size (FSIZE) and Firm Leverage (FLEVE). The interaction variables created for financial performance and four corporate governance proxies, respectively. *p*-value is in parentheses.
*Correlation is significant at 1% level.
**Correlation is significant at 5% level.
***Correlation is significant at 10% level.

imply that all the model specifications pass the autocorrelation test for the validity of the instruments.

The results of all the models in Table 8 show that the frequency of board meetings increases environmental performance, while other *CG* mechanisms do not affect environmental disclosure. Similarly, Table 9 shows that board meetings have a positive effect on environmental performance, while other *CG* mechanisms do not appear to have a link with environmental performance. Furthermore, *BSIZE*FIRMP* and *BINDE*FIRMP* affect *ENVIP* negatively and significantly, illustrating that board of directors and independent directors decrease the financial performance–environmental performance nexus. By contrast, *BMEET*FIRM* and *GDIVE*FIRMP* do

not influence *ENVIP*, implying that board meetings and women directors have no significant effect on the relationship between financial performance and environmental performance. Results in Table 9 also indicate no evidence on financial performance–environmental performance nexus. All the findings of Table 9 illustrate that corporate governance does not play a major moderating role in the financial performance–environmental performance nexus. The results of Tables 8 and 9 are similar to those reported in Tables 6 and 7.

To sum up, the findings of all these additional analyses make us fairly confident that our results do not appear to be driven by any potential endogenous sample selection problems.

8 | CONCLUSION

The China's environmental issues and problems have been on the increase over the last decade, attracting the attention of the environmental community and governments. As a result, the Chinese government started environmental reforms, including introducing environmental regulations and policies in order to address environmental challenges. Despite these reforms, studies examining the effect of corporate governance mechanisms on environmental performance in China are rare (Elmagrhi et al., 2019; Zou et al., 2019). As a result, we seek to examine the impact of internal corporate governance mechanisms (i.e., *BSIZE*, *BINDE*, *BMEET* and *GDIVE*) on *ENVIP*. Importantly, we also examine the moderating role of these corporate governance mechanisms on the financial performance–environmental performance nexus. This study, thus, contributes to the existing literature on business strategy and the environment in developing countries in the following ways.

First, this study contributes to existing literature on corporate governance and environmental performance in a developing country with high levels of environmental pollution and poor implementation of environmental laws and regulations (Chang et al., 2015). Second, our study examines the impact of internal corporate governance mechanisms on environmental performance, and their moderating role on the relationship between financial performance and environmental performance in order to address the limitations of prior studies, which only test the influence of corporate governance mechanisms on environmental performance in China (Elmagrhi et al., 2019; McGuinness et al., 2017). Third, this study contributes to the existing literature by only analysing data relating to Chinese firms operating in heavily polluting industries—the main source of environmental concerns and issues (i.e., air and water pollution). Fourth, our study employs content analysis method to develop a comprehensive environmental performance measure covering eight dimensions, namely, clarity, environmental management, environmental liabilities, environmental costs, environmental investments, environmental performance, reliability and system implementation in order to improve the generalisability of the findings of prior Chinese studies. Overall, board size and the frequency of board meetings have a positive effect on environmental performance, whilst board independence and board gender diversity do not have a significant effect on environmental performance. Finally, this study also contributes to extant literature by relying on different perspectives (e.g., agency, resource dependence, stakeholder, and legitimacies theories) to explain the relationship between *CG* and environmental performance.

Our results have important implications for policymakers and regulators. For instance, environmental performance appears to differ among our sampled firms and is generally low when compared with reported performance even in other developing countries. Therefore, policymakers and regulators, such as the Chinese government and the stock markets, can endeavour to provide clear guidance on how best to disclose environmental performance that can lead to improved environmental performance disclosures. Furthermore, although Chinese heavily polluting companies seem to comply with *CG* codes, their level of environmental performance disclosure does not appear to be high, indicating that *CG* practices in firms require further improvement. Consequently, policymakers and regulators should endeavour to encourage companies to comply fully with CG codes by providing clear guidelines and enhancing enforcement actions, including a creating compliance and enforcement committee to specifically monitor the levels of compliance among firms. In addition, regulators should provide clear guidance on how to improve capacity of directors and to select expert directors and, in particular, independent or women directors.

This study has several limitations, including (i) using a relatively small sample size, (ii) covering a comparatively short-time period, (iii) applying a simple measure of *ENVIP*, (iv) focusing on a single country, (v) inability to use alternative financial performance measures (i.e., *ROE*, *ROIC*) and (vi) using limited number of control variables (i.e., ownership structures, executive pay). Therefore, future research may develop their insights further by using a bigger sample size, a longer time period, multiple measures of *ENVIP*, a sample from multiple countries, using alternative financial performance (i.e., *ROE*, *ROIC*) and increased number of control variables (executive pay, environmental management practices, ownership). Furthermore, our study examines four *CG* mechanisms. Thus, future research may improve upon our study by employing a larger number of *CG* mechanisms. Additionally, this study relied on agency, resource dependence, legitimacy and stakeholder perspectives to predict the impact of *CG* on environmental performance. Hence, future research may rely on other perspectives, such as upper echelon and neo-institutional theories in testing the relationship between corporate governance and environmental performance.

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