

The impact of penalties for environmental violations on corporate environmental responsibility

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Abstract: Identifying firms' responses to the imposition of penalties for environmental violations in the context of corporate environmental responsibility (CER) is important to understand the impact of environmental penalties and improve their design. Using a research sample consisting of Chinese listed firms in heavy polluting sectors from 2014 to 2020, we investigate whether and how penalties for environmental violations can affect subsequent CER engagement. The empirical results show that imposing one or more environmental penalties on a firm has positive effects on the firm's subsequent CER practices. Our results remain robust after a series of tests. We also find that the role of environmental penalties in promoting CER is more pronounced in firms that receive more media coverage, have weak political connections, and operate in less competitive industries. Further analysis shows that the dynamic effect of environmental penalties on CER engagement persists at least two years after the imposition of the penalty and that environmental penalties can stimulate CER practices through both symbolic and substantive actions.

Keywords: penalties for environmental violations; corporate environmental responsibility; media coverage; political connections; industry competition

¹ Abbreviations: CER, Corporate environmental responsibility; EP, penalties for environmental violations; CEO, chief executive officer; ST, special treatment; VIF, variance inflation factors; IPE, Institute of public and environmental affairs; PSM, Propensity score matching; HHI, Herfindahl-Hirschma Index

1. Introduction

Globally, the rapid growth and development of economy can not only bring prosperity, but also lead to environmental damage to nations, especially when properly designed environmental regulations are not implemented adequately. In the foreseeable future, addressing environmental degradation and balancing economic development with environmental protection is one of the greatest challenges for firms and governments around the world (Mănescu, 2011; Tanin et al., 2019). Corporate environmental responsibility (CER), which is defined as the voluntary incorporation of social and environmental activities beyond a company's legal requirements into its business operations, is considered effective in reducing negative externalities arising from production and operations (Mackey, Mackey, & Barney, 2007). Hence, firms have been increasingly called upon to carry out their CER fulfilment better so as to contribute to environmental performance (Qin, Harrison, & Chen, 2019). Accordingly, ways of encouraging firms to engage in CER practices that alleviate severe ecological challenges are a longstanding focus for researchers all over world.

As a developing country, China must overcome environmental pollution and ecological damage as well as reducing its carbon emissions (Sun, Liu, & Chen, 2020; F. Wang, Sun, & Liu, 2019; Y. Wang, Wilson, & Li, 2021). Although many Chinese firms have made great progress in fulfilling CER commitments, room for improvement remains (Han, You, & Nan, 2019) and, in the new development context of peaking carbon emissions and the need to achieve carbon neutrality, firms must effectively fulfil CER commitments. Hence, identifying strategies for promoting fulfilment of CER has also become a critical concern in the Chinese context.

Many scholars have investigated the determinants of CER practices from different perspectives. The drivers for carrying out CER practices are commonly divided into three categories: firm characteristics, stakeholder pressure and contextual factors (González-Benito & González-Benito, 2006; Qin et al., 2019). Regulatory pressures, involving incentives and penalties, are considered effective in encouraging firms to adopt environmentally sustainable behaviours (Karassin & Bar-Haim, 2016; Symeou, Zyglidopoulos, & Gardberg, 2019). However, Shevchenko (2021) points out that scholars pay little attention to the impact of regulatory pressures in the form of penalties for environmental violations. Hence, we focus on the effect of these environmental penalties (EPs) in response to the call for further investigation of their impacts; specifically, we investigate whether EPs can affect firms' environmental behaviour.

The few studies on the impact of EPs focus on their economic consequences, for example, on stock prices, market value or shareholder wealth (Xiong, Lam, Hu, Yee, & Blome, 2021). However, the impact of EPs on the sustainability practices of firms, especially from the perspective of their CER endeavours, is largely unexplored (Shevchenko, 2021). Therefore, we

attempt to fill this research gap by studying the impact of EPs on CER practices.

Given the paucity of research on the impact of EPs on CER practices, the mechanism or route through which EPs can influence CER practices remains unclear (Y. Gao, Gu, & Liu, 2019). We first consider the role of media coverage because, as an important part of the external governance mechanism, the media can serve as an intermediary platform between firms and stakeholders (An, Chen, Naiker, & Wang, 2020; Luo, Xiong, & Mardani, 2022). Firms that engage in environmental misconduct are likely to attract significant negative media coverage, which can encourage the violating firms to pursue proactive environmental activities. Hence, we investigate whether EPs can promote CER practices through the increasing intensity of media coverage to provide in-depth insights into the nature of the focal link.

Another factor that may affect the link between EPs and CER practices is political connections. These relations or ties between the firm and the government are precious resources for a firm (Faccio, Masulis, & McConnell, 2006; Xue, Chen, Chan, & Yi, 2022). Close ties with the government may benefit firms, particularly when they experience environmental or CER-related problems, because the government has the discretionary power to monitor firms' operations and choose penalties when violations occur (Zhang, 2017; H. L. Zou, Zeng, Zhang, Lin, & Shi, 2015). Hence, we investigate whether political connections can influence the association between EPs and CER.

Industry-level characteristics are a third factor that may influence the adoption of CER activities (Radhouane, Nekhili, Nagati, & Paché, 2020). Firms in different industries face varying levels of competition and, hence, the corresponding stakeholder pressures perceived by firms also vary between industries, which can result in heterogeneous effects on firms' environmental activities (Han, Pan, Mygrant, & Li, 2021). Therefore, we investigate whether the effect of EPs on CER varies with different intensities of industry competition.

In summary, we seek to answer whether and how EPs can affect CER practices by focusing on the three mechanisms outlined. The research framework of this study is shown in Figure 1.

****Figure 1****

By addressing the questions mentioned above, this study makes several contributions to the literature on the link between EPs and CER. First, as an important element of corporate social responsibility, stakeholders are beginning to be more concerned about CER efforts (Kassinis & Vafeas, 2006), but the role of EPs has not yet been studied. As a response to stakeholders' concerns, the first contribution of this study lies in examining how firms respond to EPs from the perspective of CER practices. The second contribution is that we provide a more holistic picture of the influence of EPs on CER than has been provided to date by investigating the channels (i.e., media coverage, political connections and industry competition) through which

EPs influence CER and thus advance understanding of the focal link. The third contribution concerns our data source and sample size. Many studies are influenced by inadequate data sources (Jin, Cheng, & Zeng, 2020; X. D. Xu, Zeng, Zou, & Shi, 2016; H. L. Zou, Zeng, Zhang, et al., 2015) and limited research sample sizes. Moreover, as Y. Wang et al. (2021) note, studies on CER fulfilment by Chinese firms in particular are limited. To address this gap, we use the data retrieve from the Institute of Public and Environmental Affairs (IPE)² website to measure EPs. IPE a widely trusted database of EPs in China and a common referenced database by academic publications (Lo, Tang, Zhou, Yeung, & Fan, 2018). Hence, we can develop a larger research sample than other studies and provide new empirical evidence from an emerging country.

2. Literature review and hypotheses development

2.1 The economic consequences of EPs

Scholars investigate the economic consequences of EPs from various perspectives. Most studies examine how the stock market reacts to firms' illegal environmental activities. The results show that the stock price of a violating firm can decrease after it receives an EP (H. L. Zou, Zeng, Zhang, et al., 2015), and this market penalty mechanism is verified in the context of both developed and developing countries, including the US (Brady, Evans, & Wehrly, 2019), Europe (Bouzzine & Lueg, 2020), Canada (Lanoie, Laplante, & Roy, 1998), South Korea (Dasgupta, Hong, Laplante, & Mamingi, 2006), China (Jin et al., 2020; X. D. Xu et al., 2016), India and Mexico (Dasgupta, Laplante, Mamingi, & Wang, 2001; Gupta & Goldar, 2005).

In addition, studies examine the reputational loss to a firm incurred after the imposition of an EP, with the results indicating that EPs can damage firms' reputations (Lin, Zeng, Wang, Zou, & Ma, 2016; H. L. Zou, Zeng, Zeng, & Shi, 2015). Some studies argue that stock returns capture both the tangible (e.g., financial penalties) and intangible (e.g., reputational damage) impacts arising from EPs (Xiong et al., 2021).

Scholars also examine whether the imposition of an EP on an industry peer or supply chain member influences non-violating firms. Bouzzine and Lueg (2020) show that the Diesel gate environmental scandal not only reduced the stock returns of Volkswagen but also its industry peers. H. L. Zou, Zeng, Zhang, et al. (2015) find that peer firms in the same industry as the violating firm, and with the most similar cash flow characteristics, receive a negative response from the stock market along with the violating firm. Both studies jointly prove the contagion effect of EPs. From a supply chain perspective, Lo et al. (2018) show that if a Chinese firm is

² <http://www.ipe.org.cn>

involved in an environmental incident, its overseas customers can be affected by reductions in their market value. Considering the whole supply chain, Xiong et al. (2021) provide evidence that environmental violations have negative financial impacts not only on the violators but also on their supply chain partners, including customers and suppliers, thus verifying the spillover effects. Y. Wang, Li, Ma, and Song (2019) demonstrate the deterrence effect of EPs, as they find that firms increase their environmental investments when an industry peer receives an EP. In addition to investigating stock market reactions, scholars investigate how the credit market reacts to EPs. H. Zou, Zeng, Qi, and Shuai (2017) provide evidence that the level of loans held by violating firms can decrease after receiving EPs, thus confirming the penalty mechanism in the credit market. A small number of other studies investigate how EPs impact cash flow (Blanco, Rey-Maqueira, & Lozano, 2009), political costs (Patten & Trompeter, 2003), charitable donations (B. Wu, Jin, Monfort, & Hua, 2021) and environmental performance (Habib & Bhuiyan, 2017; Shevchenko, 2021).

2.2 Determinants of CER

Given the importance of CER in improving environmental quality and reducing adverse effects on the natural environment, researchers are interested in how to effectively encourage firms to pursue environmental activities. Scholars identify drivers of CER practices from the perspectives of stakeholder, institutional and legitimacy theories and the resource-based view (Han et al., 2019; Qin et al., 2019). In general, studies grounded on a combination of different theories can better explain the determinants rather than a single theory.

As many factors can affect firms' CER fulfilment, scholars divide the determinants into different categories according to different research purposes. Karassin and Bar-Haim (2016) classify the antecedents influencing the adoption of CER practices into institutional, organisational and individual level variables. Han et al. (2021) show that the motivations that lead firms to engage in CER practices include the intrinsic and extrinsic motivations of altruism and self-service, respectively, and the pressures to comply with the social expectations of stakeholders. Based on a literature review, González-Benito and González-Benito (2006) divide the factors determining whether firms adopting CER practices into three groups: company features, stakeholder pressures and external factors. Similarly, Qin et al. (2019) categorise the drivers into company characteristics, stakeholder pressures and contextual factors. We following this widely used method and divide the factors that drive firms to commit to CER practices into three categories, namely firm-, stakeholder- and contextual-level factors.

Differences in firm-level characteristics can result in differences in firms' CER practices (Karassin & Bar-Haim, 2016). Relevant firm features include corporate size (González-Benito & González-Benito, 2006), corporate governance (Tan, Habibullah, & Tan, 2017), board gender

diversity (Y. Wang et al., 2021), related party transactions (Choi, Chung, Rabarison, & Wang, 2021), zombie firms (Han et al., 2019), corporate financialisation (Li, Wang, Tan, & Huang, 2020) and the characteristics of top managers in the firm, such as whether the chief executive officer (CEO) is politically connected (Zhang, 2017), CEO narcissism (Al-Shammari, Rasheed, & Al-Shammari, 2019), CEO tenure (Chen, Zhou, & Zhu, 2019) and executives' hometown identification (Rong, Song, Zhang, & Liu, 2021).

Stakeholder pressures are another important driving force for CER practices. The literature divides stakeholder pressures into various categories, for instance, internal and external stakeholders, primary and secondary stakeholders, or institutional and business-related stakeholders (González-Benito & González-Benito, 2006; Qin et al., 2019). Internal stakeholders include top managers, employees, shareholders and financial institutions, while external stakeholders include the government, customers, suppliers, social communities and industrial peers (M. B. E. Clarkson, 1995). Primary stakeholders include customers, suppliers and regulators, whereas secondary stakeholders include media and nongovernmental organisations (NGOs) (Buysse & Verbeke, 2003). Institutional stakeholders are composed of government, social communities, NGOs, media and competitors, while consumers, suppliers, investors, top managers and employees are regarded as business-related stakeholders (Qin et al., 2019). The literature indicates that different stakeholders have heterogeneous effects on the fulfilment of CER activities, as they relate to firms through different social contracts (Müller, Vermeulen, & Glasbergen, 2009). Studies indicate that firms generally engage in more proactive CER activities when facing higher levels of stakeholder pressure (Qin et al., 2019).

Contextual factors are another category of drivers that lead firms to engage in CER practices. They include religion (Du, Jian, Zeng, & Du, 2014; Tsendsuren, Yadav, Han, & Mun, 2021), market competition (Tsendsuren, Yadav, Han, & Kim, 2021), environmental regulations (Han et al., 2021), the industry to which firms belong (Radhouane et al., 2020) and their geographical location (Husted, Jamali, & Saffar, 2016).

Thus, there is a comprehensive literature reviewing the antecedents of CER from many aspects. However, more investigation is required concerning how regulatory pressures in the form of EPs affect CER.

2.3 The impact of EPs on CER

To explain the role of EPs in promoting CER practices, we utilise legitimacy and stakeholder theories and the empirical results of the literature. Legitimacy theory holds that firms and society are inseparable, and that firms need to operate under a “social contract” (Suchman, 1995). Generally, firms must conform to social value systems and institutional norms to gain legitimacy. If firms' operational activities are inappropriate or unacceptable, their survival can

be threatened. Therefore, firms need to constantly legitimise their activities to meet the expectations of stakeholders and acquire and maintain the legitimacy needed for survival (Deegan, 2002; Suchman, 1995). When a firm commits environmental misconduct, its legitimacy can be threatened. In response, firms must attempt to regain their legitimacy by adopting new environmental practices, particularly in the context of increasingly strict environmental regulations (Qin et al., 2019; B. Wu et al., 2021; Zhong, Zhao, & Shahab, 2022). Habib and Bhuiyan (2017) point out that the amount of the penalties imposed on firms for environmental misconduct can increase their subsequent investment in CSR-related activities. Moreover, investors are increasingly concerned with the legitimacy threats presented by EPs (H. L. Zou, Zeng, Zhang, et al., 2015). Hence, to gain the environmental legitimacy required for their survival, firms need to take environmental actions to meet the requirements of environmental regulations. Increasing their engagement in CER practices is an effective means for firms to obtain legitimacy (Tsendsuren, Yadav, Han, & Kim, 2021).

Stakeholder theory considers that stakeholders – including employees, suppliers, customers, media, environmental NGOs, the government and local citizens – can affect the survival and development of firms (Freeman, 1984). Hence, firms must take measures to meet the requirements of their stakeholders. When firms maintain a good relationship with stakeholders, they yield significant financial benefits (Sarkis, Gonzalez-Torre, & Adenso-Diaz, 2010; Wagner & Schaltegger, 2004).

Stakeholders are paying more and more attention to environmental issues (Camilleri, 2022; González-Benito & González-Benito, 2006; Zhong et al., 2022). One of the most important stakeholders in the area of environmental problems is the government, which generally exerts coercive pressures on firms to fulfil CER obligations (Choi et al., 2021; Zhu & Sarkis, 2007). Liu et al. (2010) point out that the government can have a significant effect on firms' environmental practices. If a government agency imposes an EP on a firm, it denotes that the firm has violated the requirements of the established environmental regulations and therefore does not meet the expectations of stakeholders (Xiong et al., 2021). In response, the firm must satisfy the expectations of its stakeholders with appropriate environmental practices to secure its survival legitimacy (Qin et al., 2019). Thus, regulatory pressures in form of EPs can lead firms to increase their engagement in CER practices after a firm receives an EP. Han et al. (2021) find that environmental regulations are significantly associated with CER performance, and Ramanathan, Poomkaew, and Nath (2014) suggest that the fear of EPs has a positive influence on the environmental achievements of firms. Qin et al. (2019) confirm that firms' CER practices in China are primarily driven by the government.

As noted previously, studies have shown that EPs can result in declining stock prices and market

values as well as reputational losses (Lin et al., 2016; Xiong et al., 2021; X. D. Xu et al., 2016). To avoid further economic losses and restore their reputations, firms may focus on improving the fulfilment of their environmental responsibilities. In addition, the literature indicates that EPs are generally effective in spurring specific and general deterrence (Haque, 2018). Y. Wang et al. (2019) confirm that EPs imposed on targeted firms can have a deterrence effect on peer firms and lead them to increase their investment in environmental protection. Moreover, the firms receiving the EPs have incentives to improve fulfilment of their CER practices and avoid being punished again because of the deterrence effect.

From another perspective, building on legitimacy and stakeholder theories, as the number of EPs increases in a given year, firms face an increasing level of government pressures as well as the threat of losing their legitimacy (Shevchenko, 2021). Meanwhile, the increasing frequency of EPs not only brings great economic losses to firms (in the form of fines, decreased stock returns, reputational losses and other indirect losses), but also creates a strong deterrence effect. Firms that have been punished for environmental violations multiple times have a probability of additional (and increasing numbers of) EPs in the future (Harrington, 1988). The combination of these factors gives firms motivations to fulfil their CER. Overall, we propose the first hypothesis.

H1. Firms that receive EPs improve their implementation of CER practices in the subsequent year.

2.4 The moderating effect of media coverage

In this section, we investigate the mechanism through which EPs can affect CER. The media has always been an important platform for the public to obtain information and gain knowledge (Kölbel, Busch, & Jancso, 2017; Luo et al., 2022). The rapid development of information technology and the Internet make it even easier than before for the public to obtain information through the media channel. Given that media reports play an increasingly significant role in the creation and dissemination of information by firms, the media has become an important intermediary between firms and stakeholders (An et al., 2020). Generally, when a firm violates environmental regulations, it is widely reported by the media, which further affects the behaviour of the violating firm and other firms.

According to catering theory, the media is inclined to report news coverage that caters to the beliefs and preferences of the readers (Cahan, Chen, Chen, & Nguyen, 2015; Mullainathan & Shleifer, 2005). Moreover, the media has a strong negative bias, as readers tend to perceive negative information as far more interesting than positive information (Kölbel et al., 2017). Hence, firms that commit environmental misconduct are more likely to receive high-profile media coverage than other firms (Abebe & Acharya, 2022).

When firms are placed under pressure by media coverage of their environmental misconduct, this can significantly influence their environmental behaviour (Luo et al., 2022; Shipilov, Greve, & Rowley, 2019; Zyglidopoulos, Georgiadis, Carroll, & Siegel, 2012). K. Wang and Zhang (2021) show that the media, as an important stakeholder, plays a key role in disciplining firms' behaviour. In addition, legitimacy and stakeholder theories indicate that media coverage resulting from an EP can amplify the threat posted to firm legitimacy by the EP, and raise stakeholders' expectation of firms' CER behaviour, thus pushing firms to take appropriate responses. Consequently, firms that received more media coverage are more likely than firms with less media scrutiny to ensure that they effectively implement their CER practices. Thus, media coverage can positively moderate the link between EPs and subsequent CER practices. H. Zou et al. (2017) confirm that media coverage can intensify the negative effect of environmental violations on corporate loan financing. In summary, therefore, based on the catering, stakeholder and legitimacy theories, we expect media coverage to intensify the effect of EPs on firms' subsequent CER implementation. Hence, we propose our second hypothesis.

H2. Media coverage can strengthen the positive impact of EPs on firms' subsequent CER fulfilment.

2.5 The moderating effect of political connections

As a second moderating effect, we consider the role of political connections. Political connections involve a special form of business–government relations, and represent a precious resource to a firm (Faccio et al., 2006; Xue et al., 2022). Generally, close ties with the government give firms access to valuable resources and government protection (Zhang, 2017). For instance, firms with political connections are more likely to receive external bailouts (Faccio et al., 2006), government investment (Duchin & Sosyura, 2012) and lower tax rates than other firms (Adhikari, Derashid, & Zhang, 2006). Hence, political connections can play a crucial role in the process of firms' strategic decisions (Faccio et al., 2006).

When firms have been penalised for environmental violations, those without political connections cannot easily seek the help and protection of the government. Consequently, as legitimacy and stakeholder theory confirm, firms must fulfil their CER practices to meet the expectations of stakeholders and achieve the legitimacy required for survival (Liu et al., 2010; Zhong et al., 2022). However, firms with political connections in this situation may be able to alleviate the levels of penalties imposed because the government has some discretionary power in regulation and supervision management (Faccio et al., 2006; H. L. Zou, Zeng, Zeng, et al., 2015). Hence, their political connections may shelter such firms to an extent, permitting them to engage in environmentally harmful behaviour with less fear of consequences than firms without political connections (Muttakin, Mihret, & Khan, 2018). Han et al. (2021) document

that political connections can reduce the positive role of environmental regulations in promoting CER practices among non-state-owned enterprises in China. In summary, when firms commit environmental wrongdoings, their political connections may weaken the positive impact of EPs on subsequent CER practices. Therefore, we propose our third hypothesis as follows.

H3. Political connections can weaken the positive impact of EPs on firms' subsequent CER fulfilment.

2.6 The moderating effect of industry competition

From the perspective of industry-level characteristics, we investigate the moderating role of industry competition in the relationship between EPs and CER behaviour. The intensity of competition varies between firms in different industries owing to inherent differences among industries (Han et al., 2021). These different levels of competitive intensity may influence firms' environmental behaviour in different ways (Meng, Zeng, Xie, & Qi, 2016).

Building on legitimacy and stakeholder theories, we consider that firms in more competitive environments are more inclined to fulfil CER practices. Such firms must fulfil CER commitments to obtain crucial resources for survival, legitimacy and stakeholder satisfaction, particularly given the increasing awareness of environmental protection and the increasing pressures of environmental regulations (González-Benito & González-Benito, 2006; Qin et al., 2019). We argue that firms in highly competitive industries naturally pay more attention to building their competitive advantage compared with firms in less competitive industries. Studies highlight that CER practices can be viewed as strategic tools that bring financial benefits and competitive advantage to firms (Camilleri, 2022; Meng et al., 2016; Pucheta-Martínez & Chiva-Ortells, 2018; Tsendsuren, Yadav, Han, & Kim, 2021). Specifically, CER fulfilment can help firms to build a good reputation, create a favourable corporate image and attract consumers who favour green products, thereby helping them to establish a competitive advantage and increase their profitability. Fernández-Kranz and Santaló (2010) demonstrate that firms in more competitive environments have better corporate social responsibility performance than firms in less competitive environments. Thus, in more competitive industries, firms have greater economic incentives to fully implement CER practices to cement their competitive advantage.

To conclude, we consider that firms in industries with intense competition that are punished for environmental violations are more likely to engage in subsequent CER practices. In a similar study, Han et al. (2021) show that the impact of environmental regulations on CER practices is more pronounced in highly competitive industries than in less competitive industries. Hence, we argue that industry competition can positively moderate the impact of EPs on CER practices.

Based on the above discussion, we put forward the fourth hypothesis.

H4. Industry competition can strengthen the positive impact of EPs on firms' subsequent CER fulfilment.

3. Research design

3.1 Sample and data source

We select Chinese public firms listed on the Shanghai and Shenzhen Stock Exchanges as our initial research sample. Generally, firms in heavy polluting sectors are the main sources of environmental pollutants and are more likely to commit environmental violations. Hence, we select listed firms within heavily polluting industries for our research sample based on the *Guidelines for environmental information disclosure of listed companies* released in 2012, which indicate that there are 16 heavy polluting sectors. To avoid the effect of abnormal financial conditions, we remove from our sample all special treatment (ST) firms (firms with abnormal financial or other conditions) and *ST firms (firms that have experienced losses for 3 years and been issued a delisting warning). Firms with missing data are also eliminated from the sample.

The Environmental Protection Law in China was amended in 2014, with the result that it has become “the strictest law in history”, exerting enormous pressure on firms to manage their environmental impacts (Jin et al., 2020; Liao, Weng, & Shen, 2020). The amendment significantly affects firms' environmental behaviour and requires them to consider appropriate reactions if they have violated environmental rules and regulations. Hence, we select 2014 as the commencement of our research period. After screening, our final sample consists of 4,601 firm-year observations for the 2014–2020 period.

We collect the data required for our study from multiple databases. Data related to CER are manually collected from firms' annual reports, corporate social reports and environmental reports by content analysis. The data on EPs are obtained from IPE, a Beijing-based non-profit environmental organisation supported by the central government that develops and publishes a pollution map database for China to monitor corporate environmental performance. The IPE database provides detailed information on firms and their affiliated subsidiaries that violate environmental regulations, including firms' names, the type of illegal activity and the penalties received. IPE collect the data of EPs from several authoritative sources, such as official websites of central and local environmental protection agencies, news service agencies at different levels, firms' corporate social responsibility reports and websites of listed firms. Hence, IPE can gather information of EPs from disaggregated data sources and provide a comprehensive EP database. The data provided by IPE is treated as a renowned source of EPs in China and several previous

studies that published in reputed journals have also employed the data from IPE (Lo et al., 2018). Data for media coverage are retrieved from the Chinese Research Data Services Platform, and remaining data are gathered from the China Stock Market and Accounting Research database. We winsorise all continuous variables to eliminate the effect of outliers.

3.2 Definitions of variables

3.2.1 Dependent variable: CER

Scholars adopt many different proxies to measure CER. One widely adopted method uses data retrieved from databases provided by third-party independent rating agencies. The most commonly used databases include ASSET4 (Gangi, Daniele, & Varrone, 2020; Graafland, 2019), Kinder, Lydenberg and Domini (Al-Shammari et al., 2019; Chen et al., 2019; Kim & Statman, 2012; Zyglidopoulos et al., 2012), Bloomberg ESG (Xie, Nozawa, Yagi, Fujii, & Managi, 2019) and Hexun (Xue et al., 2022; Zhong, Xu, Liao, & Zhang, 2019). Another common method is employing content analysis to measure CER by accessing relevant environmental responsibility information disclosed in annual, corporate social and sustainability reports (Shah, Sarfraz, & Ivascu, 2021; Y. Wang et al., 2021; W. Wu, Liang, & Zhang, 2020; F. Xu, Yang, Li, & Yang, 2020). Some studies use the results of survey questionnaires to represent CER (Y. Gao et al., 2019; Lee, Kim, & Kim, 2018; M. Walker & Mercado, 2015). A small number of researchers use other indicators to capture CER, such as whether the firm has an ISO 14000 or ISO 14001 environmental certificate (Wahba, 2008), investments in environmental protection (Jiang, Yang, Yang, & Zhang, 2021), the ratio of environmental protection subsidies (Peng, Chen, Elahi, & Wan, 2021) and environmental performance (Shih, Wang, Zhong, & Ma, 2021).

Although Hexun provides ratings of overall CSR performance from 2010, the environmental dimensions of CSR performance for all listed firms have been zero since 2018 (Zhao, Zhong, Liao, Ye, & Deng, 2022; Zhong et al., 2019). Therefore, we do not use the CER ratings provided by Hexun. Instead, to provide an overall picture of CER practices, we follow W. Wu et al. (2020), F. Xu et al. (2020) and Zhang (2017) and use content analysis by collecting environmental responsibility information disclosed in firms' CSR reports, annual reports and sustainability reports to measure CER. We evaluate environmental responsibilities in three dimensions, namely, governance, supervision and management (Qin et al., 2019), and each dimension has several specific evaluation indicators. For the environmental governance dimension, if a firm carries out concrete and detailed environmental governance activities, the indicator takes a value of 2; this requires that the firm takes specific measures and discloses monetary or quantitative information about these measures. If the firm carries out general and simple activities, that is, if it discloses non-monetary or qualitative information about its

relevant activities (F. Xu et al., 2020), the indicator takes a value of 1. If the firm does not carry out relevant activities, the indicator takes a value of 0. For the remaining two dimensions, environmental supervision and management, each indicator is a binary variable and takes a value of 1 or 0 depending on whether the firm conducts or does not conduct such activities, respectively. The details of the measurement system are provided in Table 1. CER is the sum of the scores of each indicator, with higher scores denoting better CER practices.

To ensure accuracy in the process of assigning CER scores according to the environmental responsibility information disclosed by the firms, we assigned two groups of research assistants to score each indicator. In the case of any inconsistencies, a third group double checked and assigned the final score.

****Table 1****

3.2.2 Independent variable: EPs

Unlike the measurement of CER, the measurement of EPs is relatively consistent in the literature. Following Shevchenko (2021) and Abebe and Acharya (2022), we construct two proxies (*Penalty* and *Penalty_count*) to represent EPs. *Penalty* is a binary variable with a value of 1 if the firm has received a penalty for an environmental violation in a given year and 0 otherwise. In China, EPs include a warning, fine, immediate or deadline correction, suspension of business for rectification, confiscation of illegal gains, administrative detention, or shut down. *Penalty_count* is constructed to represent the total number of EPs imposed on a firm and its affiliated subsidiaries in a given year.

3.2.3 Moderators

3.2.3.1 Media coverage

To capture media coverage, most studies use the number of news reports appearing in paper media (Du, Chang, Zeng, Du, & Pei, 2016). Today, however, people are more inclined to search for information using the Internet rather than paper media (Cheng & Liu, 2018). Hence, to comprehensively capture the intensity of media coverage (*Media*), we use the total number of annual environmental news articles appearing in both paper media and the Internet. To further address the skewness of raw data, following Du et al. (2016) and X. Gao, Xu, Li, and Xing (2021), we take the natural logarithm values of one plus the total number of annual environmental news reports appearing in both media papers and on the Internet.

3.2.3.2 Political connections

Political connections are denoted by firms with a CEO or chairman who is a current or former government official (serving in government agencies at or above the county level, the municipal people's congress, or the army). Following Zhang (2017) and Huang, Li, and Liao (2021), we create a new dummy variable (*PC*) to measure political connections. *PC* takes a value of 1 if

the firm's chairman or CEO is a current or former government official and 0 otherwise.

3.2.3.3 Industry competition

Following Han et al. (2021), we use the Herfindahl–Hirschman Index (HHI) to measure the intensity of industry competition. *HHI* equals the sum of the squared share of each firm's sales to total sales in the same industry (Quan, Ke, Qian, & Zhang, 2021). Higher *HHI* values indicate lower industry competition.

3.2.4 Control variables

Following Han et al. (2019), Han et al. (2021), Y. Wang et al. (2021) and Tsendsuren, Yadav, Han, and Kim (2021), we control a series of variables that are likely to affect CER practices. We include firm size (*Asset*), financial leverage (*Lev*), firm age since establishment (*EstAge*), revenue growth (*Growth*), firm profitability (*ROA*), board size (*Board*), board independence (*Independent*), shareholder structure (*Balance*), largest shareholder (*TOPI*), duality of the CEO and chairman (*Dual*), firm cash flow (*Cashflow*) and agency costs (*Cost*). Year and industry fixed effects are also incorporated. The details of the variables included in this study are provided in Table 2.

****Table 2****

3.3 Model design

To test the impact of EPs on CER, we construct Models 1a and 1b as follows:

$$CER_{i,t+1} = \beta_0 + \beta_1 Penalty_{i,t} + \sum_{j=1}^k \beta_j Controls_{i,t} + \eta_j + \gamma_t + \varepsilon_{it} \quad (\text{Model 1a})$$

$$CER_{i,t+1} = \beta_0 + \beta_1 Penalty_count_{i,t} + \sum_{j=1}^k \beta_j Controls_{i,t} + \eta_j + \gamma_t + \varepsilon_{it} \quad (\text{Model 1b})$$

where *i* and *t* indicate firm and year, respectively. $CER_{i,t+1}$ means the CER scores that firm *i* obtains in year *t* + 1. The independent variable and control variables are all lagged by 1 year because there may be a lag before the effect of EPs on CER is evident. In addition, this addresses endogeneity to some extent (Han et al., 2021; W. Wang, Zhao, Jiang, Huang, & Li, 2021). η_j and γ_t denote industry and year fixed effects, respectively, and ε_{it} is the disturbance term.

To further examine the moderating effects, we build on Models 1a and 1b to construct Models 2a and 2b. We add the moderator (i.e., media coverage, political connections or industry competition) and the interaction term between EPs (i.e., *Penalty*, *Penalty_count*) and the moderator into separate regression models. To avoid multicollinearity problems, the interaction terms are centred before being added into the models.

$$CER_{i,t+1} = \beta_0 + \beta_1 Penalty_{i,t} + \beta_2 Moderator_{i,t} + \beta_3 Penalty_{i,t} * Moderator_{i,t} + \sum_{j=1}^k \beta_j Controls_{i,t} + \eta_j + \gamma_t + \varepsilon_{it} \quad (\text{Model 2a})$$

$$CER_{i,t+1} = \beta_0 + \beta_1 Penalty_count_{i,t} + \beta_2 Moderator_{i,t} + \beta_3 Penalty_count_{i,t} * Moderator_{i,t} + \sum_{j=1}^k \beta_j Controls_{i,t} + \eta_j + \gamma_t + \varepsilon_{it} \quad (\text{Model 2b})$$

4. Empirical results

4.1 Descriptive statistics and correlation relationship

The descriptive statistics of all variables are shown in Table 3. The values of the mean and standard deviation of *CER* are 9.268 and 4.699, respectively. These results show that the fulfilment of CER practices varies significantly different between firms. The mean value of *Penalty* is 0.238, indicating that 23.8% of firms in our sample have been penalised for environmental violations. For *Penalty_count*, the minimum value is 0 (as would be expected), but some firms received up to 33 penalties in a year. Moreover, the standard deviation is 4.635, indicating large differences between firms in the number of EPs received. The mean value of *Media* is 5.425, which is quite close to its median value. The mean value of *PC* is 0.322, suggesting that 32.2% of firms in our sample have political connections.

****Table 3****

We perform univariate tests to compare whether the mean and median values of the main variables are significantly different. We first divide the whole sample into two groups according to whether a firm has received an EP, with the results presented in Table 4. The mean and median values of *CER* are significantly higher for violating firms than for non-violating firms, supporting the argument that firms have greater incentives to pursue CER practices if they have received an EP. For media coverage, the mean and median values of *Media* are significantly higher in the group of violating firms than for non-violating firms indicating that firms face more media pressures after the imposition of EPs.

****Table 4****

Next, we divide the whole sample into two groups based on the annual median values of *Media*. The results are shown in Table 5. The mean and median values of *Penalty* and *Penalty_count* are significantly higher for firms that receive high-profile media coverage than for firms that receive less media coverage. Moreover, the fulfilment of CER for firms with high media coverage is significantly better than for firms with low media coverage.

****Table 5****

The whole sample is further divided by whether a firm has political connections. Table 6 reports the results, which indicate that firms without political connections tend to receive more EPs and to implement CER actions well compared with other firms.

****Table 6****

Finally, we divide the full sample by the annual median values of *HHI* and present the results in Table 7. Firms that belong to less competitive industries receive more EPs and fulfil subsequent CERs better than other firms.

****Table 7****

For brevity, we provide the correlation matrix for the main variables only in Table 8. Both *Penalty* and *Penalty_count* are positively and significantly correlated with *CER*. In addition, the correlations between *Penalty* and *Media* and between *Penalty_count* and *Media* are positive and significant at the 1% level, as is the correlation between *Media* and *CER*. Both *Penalty* and *Penalty_count* are negatively correlated with *PC* and positively correlated with *HHI*.

****Table 8****

4.2 Empirical results

4.2.1 The impact of EPs on CER

Before estimating the regression model, we perform multicollinearity tests. The results show that both the highest values and the means values of the variance inflation factors are less than 10, suggesting that multicollinearity is not a problem in this study (Mason & Perreault, 1991). The regression results of the impact of EPs on *CER* are presented in Table 9. The impact of *Penalty* on CER_{t+1} is positive and significant ($\beta = 0.806, p < 0.01$). The result supports the argument that receiving an EP leads firms to improve their CER practices in the following year. Similarly, the link between *Penalty_count* and CER_{t+1} is positive and significant ($\beta = 0.055, p < 0.01$), indicating that a higher number of EPs is associated with better fulfilment of CER practices in the following year. Taken together, the results indicate that receiving one or more EPs in a given year can lead firms to improve their subsequent implementation of CER. Thus, H1 is also supported.

****Table 9****

4.2.2 The moderating effect of media coverage

We examine the moderating effect of media coverage on the link between EPs and *CER*. The results are reported in Table 10. In column (1), *Penalty* affects CER_{t+1} positively ($\beta = 0.726, p < 0.01$) as does *Media* ($\beta = 0.180, p < 0.05$). The coefficient of the interaction term (*Penalty*Media*) is also positive and significant ($\beta = 0.617, p < 0.01$). The results shown in column (2) are similar. The coefficient of the interaction term (*Penalty_count*Media*) is positive and significant ($\beta = 0.041, p < 0.01$). Overall, these results show that the positive effect of EPs on CER_{t+1} is more pronounced when firms receive more media coverage. The moderating effect of media coverage is shown in Figures 2 and 3. Hence, we can conclude that media coverage strengthens the positive effect of EPs on CER_{t+1} , which supports H2.

****Table 10****

****Figure 2****

**** Figure 3****

4.2.3 The moderating effect of political connections

Next, we explore whether the direct link between EPs and *CER* can be moderated by political

connections. The results are also reported in Table 10. Column (3) shows that CER_{t+1} is positively and significantly influenced by both *Penalty* ($\beta = 0.756, p < 0.01$) and *PC* ($\beta = 0.337, p < 0.05$), while the interaction term (*Penalty*PC*) has a negative and significant effect on CER_{t+1} ($\beta = -1.279, p < 0.01$). The results in column (4) are quite similar, as the coefficient of the interaction term (*Penalty_count*PC*) is negative and significant ($\beta = -0.066, p < 0.05$). The results suggest that the positive effect of EPs on CER_{t+1} is more pronounced for firms without political connections. Figures 4 and 5 show the moderating effect of political connections. Overall, the positive effect of EPs on CER_{t+1} can be weakened by political connections, which is consistent with H3.

****Figure 4****

**** Figure 5****

4.2.4 The moderating effect of industry competition

Finally, we examine how industry competition can affect the relationship between EPs and *CER*. Table 10 reports the results. In column (5), *Penalty* has a positive effect on CER_{t+1} ($\beta = 0.924, p < 0.01$), *HHI* has a negative effect on CER_{t+1} ($\beta = -2.438, p < 0.01$) and the interaction term (*Penalty*HHI*) is significantly positive ($\beta = 4.946, p < 0.01$). The results of column (6) are similar, except that the coefficient of the interaction term (*Penalty_count*HHI*) is positive but insignificant ($\beta = 0.100, p = \text{n.s.}$). Noting that higher values of *HHI* suggest lower industry competition, our results show that the positive effect of *Penalty* on CER_{t+1} is more pronounced in less competitive industries. Industry competition can weaken the effect of EPs in promoting subsequent CER fulfilment and, therefore, H4 is rejected. The moderating effect of industry competition is reported in Figure 6.

**** Figure 6****

4.3 Robustness tests

To ensure the robustness of our main results, we conduct several tests, detailed in this section.

4.3.1 Endogeneity issues

4.3.1.1 Heckman two-stage model

To address potential sample selection bias, we adopt a Heckman two-stage model as the first robustness test. In stage 1, we employ a probit model to estimate the probability of whether a firm receives an EP and to obtain the inverse Mills ratio (IMR). Following Quan et al. (2021), we use the annual mean values of *Penalty_count* within the same industry (*MeanPenalty1*) and the annual mean values of *Penalty_count* within the same province (*MeanPenalty2*) as the instrument variables. In addition, we incorporate all control variables mentioned in Subsection 3.2.3 into the probit model. In stage 2, we incorporate the IMR obtained in stage 1 and all other

variables into the final model. The results, shown in Table 11, indicate that selection bias exists in our study, as the coefficients of IMR in columns (2) and (3) are both significant. However, our main results remain unchanged.

****Table 11****

4.3.1.2 Propensity score matching (PSM)

The propensity score matching (PSM) method is widely used to address potential endogeneity problems. We also adopt PSM to alleviate the endogeneity issue in this study. Specifically, we first select several covariate variables and employ the logit model to estimate the propensity scores for a firm receiving an EP. The covariate variables are the same as the control variables discussed in Subsection 3.2.3. Second, we use the nearest-neighbour matching procedure to match each treatment firm ($Penalty = 1$) with a control firm ($Penalty = 0$) using the propensity scores. We set the calliper as 0.01 and conduct matching with replacement. Finally, we use the matched sample to conduct the regression again.

The regression results of the matched sample are shown in columns (4) and (5) of Table 11. Although the number of observations decreases to 1,169 due to the restriction of the successfully matched sample, our results remain consistent with the baseline results, which indicates their robustness.

4.3.2 Other robustness checks

4.3.2.1 Alternative measurement of EPs

As discussed earlier, we construct two variables ($Penalty$ and $Penalty_count$) to measure EP. Now, we construct an alternative variable for EP, $Penalty_degree$, which considers the intensity of EPs. IPE discloses the detailed EP information received by firms. According to the specific penalty received by a firm and its subsidiaries, and following the real practice in several Chinese provinces (i.e., Ningxia and Jilin Provinces)³, we assign different scores (ranging from 1 to 12) to each EP on the basis of the severity of punishment. The final scores are the sum of the corresponding scores of all penalties that a firm receives in a given year. We use the final scores to measure $Penalty_degree$. The higher the score, the higher is the intensity of the EPs. The results are provided in column (1) of Table 12, which indicates that our main results remain unchanged.

****Table 12****

4.3.2.2 Alternative measurement of CER

Although we select listed firms in heavy polluting sectors as our research sample in this study, how firms respond to EPs may vary between industrial sectors (Radhouane et al., 2020).

³http://www.changbaishan.gov.cn/zwdt/zfgg/201801/t20180119_106289.html; https://www.thepaper.cn/newsDetail_forward_5017886

Following Wang et al. (2021), we account for the industry effects on firms' CER practices and use the industry-average-adjusted CER (*Ind_CER*) as a new proxy for CER to address this issue. Specifically, we calculate the annual mean CER values of each industry and determine *Ind_CER* as the real CER score of a firm minus the annual average CER in its particular industry. We use *Ind_CER* as the new dependent variable and conduct the regression again. The regression results, shown in columns (2) and (3) of Table 12, are consistent with our baseline results.

4.3.2.3 Ordered logit model

In our study, *CER* is a discrete ordered variable that ranges from 3 to 23. In addition to the ordinary least squares method, following Cabeza-García, Fernández-Gago, and Nieto (2018), Han et al. (2021) and de Villiers and Marques (2016), we employ an ordered logit model to estimate the coefficients. Columns (4) and (5) of Table 12 report the relevant results. Again, our results remain robust.

4.4 Additional analysis

4.4.1 The dynamic effect of EPs on CER

It is possible that there is a lag before the effects of EPs on CER become evident. Hence, we examine how the CER-promoting effect of the EPs varies over time using a new dependent variable, CER_{t+2} instead of CER_{t+1} . Columns (1) and (2) of Table 13 report the results, which remain consistent with the main results and confirm that EPs continue to exert positive and significant effects on CER practices in the two years that follow their imposition.

****Table 13****

4.4.2 The effect of EPs on different types of CER

Studies highlight that firms may adopt different kinds of corporate social responsibility strategies to maintain legitimacy, namely symbolic or substantive strategies (Zhong et al., 2022). Similarly, as different firms may implement different CER strategies as a response to EPs, studies divide CER practices into symbolic and substantive actions (see K. Walker and Wan (2012)). Generally, symbolic CER actions refer to what firms plan to do in the future, whereas substantive CER actions indicate what concrete actions or steps firms are taking (or have completed) to benefit the natural environment. Obviously, different types of CER actions influence environmental quality differently. Therefore, we are interested in whether EPs promote the fulfilment of CER practices via different types of actions.

We divide CER practices into the two categories following P. M. Clarkson, Li, Richardson, and Vasvari (2008) and K. Walker and Wan (2012) and create the two corresponding dependent variables, *CER_symbolic* and *CER_substantive*. Appendix I provides details on the classification of CER actions. We run the same regression model using the new dependent variables and report the results in columns (3) to (6) of Table 13. The results indicate that EPs

can promote both symbolic and substantive CER actions. Hence, although some actions are symbolic, EPs can also stimulate the fulfilment of CER through concrete or specific actions, thus benefiting the natural environment.

5 Discussion

The role of regulatory pressures in encouraging firms to adopt environmentally sustainable behaviour is explored in the literature but the impact of regulatory pressure in the form of EPs in particular on CER engagement has been neglected. Hence, we investigate whether and how EPs can influence firms' subsequent CER endeavours. We first summarise the result of our empirical analysis in Table 14 and confirm which of our four hypotheses are validated.

****Table 14****

Our results show that Eps has a positive impact on CER of firms and thus support H1. Both the likelihood and the frequency of EP imposition on a firm in a given year lead to a subsequent improvement in CER practices. Our research confirms the positive effect of EPs, a result which aligns with the few relevant studies in the literature (Han et al., 2021; Qin et al., 2019). In line with legitimacy and stakeholder theories, our results provide evidence that regulatory pressures in the form of EPs can play an essential role in shaping firms' behaviour within the Chinese institutional context. Hence, we highlight the vital role of EPs in encouraging the sustainability practices of firms.

More results from our study reiterate the positive link between EPs and CER. Our further results show that the effect of EPs in promoting CER practices remains positive and significant in the 2 years after an EP has been imposed⁴. This is an interesting finding in our research. This lagged analysis shows that dynamic effect of EPs on CER in year t+2 still remains positive, thus boosting the cause for strong EPs. In fact, additional research by the authors (not reported in this paper due to lack of space) shows that the impact of EPs on CER still remains in later years though the impact starts to weaken in year t+3. We feel this is a very significant finding that has significant policy relevance, as the results provide evidence to policy makers that an appropriately designed EPs can have better impact on CER of corporations for a long time.

Our study provides a comprehensive picture of the nature of the focal link by investigating the mechanisms through which EPs can affect CER practices, via media coverage, political connections and industry competition. The media is an important part of external governance. Our results indicate that the positive effect of EPs in promoting CER practices is reinforced when firms receive more rather than less media coverage. Hence, H2 is supported. The results

⁴ We thank the anonymous reviewer for making this interesting suggestion to check the impact of EPs on CER in more later years.

are consistent with the predictions of catering, legitimacy and stakeholder theories, and emphasise that the media can reduce or eliminate information asymmetry and serve as an intermediary platform between firms and stakeholders, enhancing the discipline imposed on firms' environmental activities (X. D. Xu et al., 2016). In confirming the supervisory role of the media, our results agree with studies in the literature (Chang, He, Jin, Li, & Shih, 2020; K. Wang & Zhang, 2021). Given the important role that media coverage can play in shaping the link between EPs and subsequent CER, media can serve as an effective external governance mechanism to regulate firms' environmental actions.

Our results show that political connections can weaken the positive effect of EPs on CER, which supports H3. Our findings contradict studies by K. Wang et al. (2018) and Zhang (2017), which argue that political relations can encourage firms to achieve sustainable practices because the firms wish to obtain valuable resources from the government, or because senior managers desire political promotion (Z. Wang, Reimsbach, & Braam, 2018). Conversely, our results indicate that political connections may shelter firms, enabling them to engage in environmentally harmful behaviour that would attract penalties for firms without political connections. The results are consistent with the predictions of helping hand theory, which argues that political connections represent a precious resource for firms' favourable decisions (Zhang, 2017). In this regard, our results accord with the conclusion of Han et al. (2021) and Muttakin et al. (2018). Hence, it is vital to prevent firms' rent-seeking behaviour in establishing political connections with the government to reduce the negative effect of political connections on the link between EPs and CER.

Finally, H4 predicts that the positive effect of EPs on CER is stronger in more competitive industries. However, our results suggest the opposite effect, that EPs have a stronger effect on CER in less competitive industries. Our conclusions are consistent with studies by Quan et al. (2021) and Tsendsuren, Yadav, Han, and Kim (2021). That is, our results indicate that improving firms' CER fulfilment is dependent on imposing mandatory requirements (i.e., EPs) in *less* competitive industries. These findings raise the question of why firms' willingness to fulfil CER practices declines with the increase of industry competition. The reason may be that firms' resources are limited, and fulfilling CER measures may impose burdensome operating costs, reducing the profitability of firms (Campbell, 2007; Meng et al., 2016). The benefits that engaging in CER practices can bring is hard to see in the short term. Hence, firms in highly competitive industries in particular rarely have economic incentives to invest their limited resources in CER fulfilment, which weakens the positive effect of EPs on CER practices.

Though the focus of this paper is on China, we believe that the research methodology and results are applicable to the global context linking environmental violations to CER. All countries have

the need to impose EPs for firms that violate environmental laws and would be keen to assess the efficiencies of their policies. Our results do provide evidence that EPs are in general working in helping firms focus more on their corporate environmental responsibilities. Though our data set is limited to Chinese context, this finding could trigger similar analysis in multiple country contexts by researchers worldwide.

6. Conclusions and limitations

Given the important role of CER practices in reducing damage to the natural environment, it is important to determine how to promote CER practices by firms and, in particular, to understand the role of EPs in promoting CERs. Specifically, we investigate whether and how EPs imposed on violating firms can affect their subsequent fulfilment of CER practices. We use Chinese listed firms in heavy polluting sectors for the 2014–2020 period as our research sample. The empirical results show that the imposition of an EP (or multiple EPs) on firms in a given year has positive effects on the firms' subsequent fulfilment of CER measures. Our results remain robust after a series of tests. In addition, we find that the positive effect of EPs on firms' subsequent CER fulfilment can be strengthened by high levels of media coverage, but is weakened by political connections and industry competition. The results of our additional analysis indicate that EPs continue to exert positive effect on CER fulfilment in the two years following their imposition on a firm, and that EPs can stimulate CER practices not only in the form of symbolic actions but also substantive actions.

Our results have several valuable policy implications. First, the government should ensure that different types of environmental regulations can be implemented strictly to fully utilise EPs as an instrument that can promote CER practices. If firms violate environmental rules and laws, proportional penalties are essential. Second, given that media coverage is an important channel through which EPs lead to the fulfilment of CER measures, the government should ensure that the media's governance mechanism can operate effectively and encourage the media to focus on firms' environmental misconduct. Third, to ensure EPs can have a positive effect on CER practices, it is essential to reduce the negative impact of political connections on this relationship by preventing rent-seeking behaviour by firms through their political connections. Hence, the government should enhance transparency and fairness in policy implementation and reduce the scope for rent-seeking behaviour. Finally, the accelerating process of marketisation in China will inevitably lead to firms facing increasingly competitive environments. Given that strong industry competition may weaken the positive role of EPs, it is important to establish channels for firms to build competitive advantage using the implementation of CER practices, rather than solely through economic criteria. In this way, firms will have incentives to

implement CER practices, even in more competitive industries.

This study offers several important contributions to the literature. First, how firms respond after receiving an EP is unclear based on the literature to date. In addition, most studies focus on investigating changes in stock prices or market values of violating firms after the imposition of EPs, rather than examining CER practices. To address this research gap, we investigate the consequences of EPs from the perspective of CER practices rather than stock market reactions. Second, we provide a broader picture of the association between EPs and CER than has been provided in the literature by incorporating the moderating roles of media coverage, political connections and industry competition into the research framework and investigating the channels through which EPs promote CER. Finally, compared with the relevant literature, we obtain more accurate and complete data on EPs using the IPE database and achieve a larger research sample than has been achieved in other studies. Hence, we can provide new empirical evidence from an emerging country, China, on the role of EPs on CER.

This study is subject to some limitations. First, we only use Chinese listed firms in heavy polluting sectors as our research sample. Second, we use content analysis to manually collect data from annual, corporate social and sustainability reports to measure CER. Thus, our study may suffer from the weakness of a lack of generalisability. Hence, future studies can attempt to broaden the research sample and retrieve CER data provided by authoritative independent parties, such as Bloomberg and Syntao database. Finally, we do not examine whether the improvements in CER practices in response to EPs result in financial benefits to firms. In future research, we plan to investigate this issue. Despite these limitations, this study sheds new light on the impacts of EPs on CER practices and the moderating roles of media coverage, political connections and industry competition.

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Table 1 The measurement of CER

Dimensions	Indicators	Scoring criteria
Environmental governance responsibility	Whether the firm carries out emission reductions and treatments of waste gas	No = 0; Yes with general and simple measures = 1; Yes with concrete and detailed measures = 2.
	Whether the firm carries out emission reductions and treatments of wastewater	
	Whether the firm carries out emission reductions and treatments of soot and dust	
	Whether the firm carries out the utilisation and treatment of solid waste	
	Whether the firm deals with pollution from noise, light and radiation	
Environmental supervision responsibility	Whether the firm implements clean production	No = 1; Yes = 0 ⁵ .
	Whether the firm is the national key supervision unit	
	Whether the firm has any major environmental pollution incidents	
	Whether the firm has any environmental petition events	Yes = 1; No = 0.
	Whether the firm meets the emission standard for pollutant discharges	
Whether the firm certifies ISO 14001		
Whether the firm certifies ISO 9001		
Environmental management responsibility	Whether the firm's relevant documents include environmental protection, environmental policy, environmental management organisation, circular economy development mode, green development and other related environmental contents	Yes = 1; No = 0.
	Whether the firm discloses the achievements of past environmental goals and clarifies future environmental goals	
	Whether the firm formulates a series of rules and regulations related to environmental management systems	
	Whether the firm carries out education and training on environmental protection for employees	
	Whether the firm participates in public welfare activities, especially environmental protection activities	
	Whether the firm establishes an emergency mechanism for major environmental incidents	
	Whether the firm receives environmental protection awards	
Whether the firm implements the "three simultaneous" system		

⁵ Because these are negative events, we allocate 1 for No and 0 for Yes to avoid having negative events increase the CER score.

Table 2 Definitions and measurements of variables

Types of variables	Name	Measurement
Dependent variable	<i>CER</i>	Using the method of content analysis mentioned above
Independent variable	<i>Penalty</i>	Binary variable, equal to 1 if the firm and its affiliated subsidiaries have received a penalty for an environmental violation in a given year, and 0 otherwise
	<i>Penalty_count</i>	The total number of penalties that the firm and its affiliated subsidiaries have received in a given year for environmental violations
Moderator	<i>Media</i>	$\ln(1 + \text{the total number of annual environmental news reports})$
	<i>PC</i>	Dummy variable, equal to 1 if the firm's chairman or CEO is or used to be a government official, and 0 otherwise
	<i>HHI</i>	The sum of the squared share of each firm's sales to total sales in the same industry
Control variables	<i>Asset</i>	$\ln(\text{Total assets})$
	<i>Lev</i>	Liabilities/Assets
	<i>EstAge</i>	$\ln(\text{the number of years since the firm was founded})$
	<i>Growth</i>	$(\text{Revenue} - \text{lagged revenue})/\text{Revenue}$
	<i>ROA</i>	Net profitability/Total assets
	<i>Board</i>	The total number of the board of directors
	<i>Independent</i>	The proportion of the independent directors in the board
	<i>Balance</i>	The shareholding proportion of the largest shareholder/The shareholding proportion of the second shareholder
	<i>TOP1</i>	The shareholding proportion of the largest shareholder
	<i>Dual</i>	Dummy variable, equal to 1 if the CEO and the chairman of the firm are the same person, and 0 otherwise
	<i>Cashflow</i>	The net cash flow from operating activities/Total assets
<i>Cost</i>	Administrative expenses/Revenue	

Table 3 Descriptive statistics

Variable	N	Mean	SD	Median	Min	Max
CER	4601	9.268	4.699	8	3	23
Penalty	4601	0.238	0.426	0	0	1
Penalty_count	4601	1.554	4.635	0	0	33
Media	4601	5.425	0.947	5.394	2.944	8.241
PC	4601	0.322	0.467	0	0	1
HHI	4601	0.098	0.094	0.078	0.022	1
Asset	4601	22.32	1.306	22.11	19.95	26.37
LEV	4601	0.398	0.198	0.384	0.0420	0.952
EstAge	4601	2.927	0.277	2.956	2.041	3.527
Growth	4601	13.29	27.35	9.639	-51.97	201.1
ROA	4601	4.646	5.415	4.040	-19.68	21.65
Cashflow	4601	0.061	0.064	0.060	-0.137	0.260
Cost	4601	0.080	0.053	0.070	0.007	0.427
Board	4601	8.691	1.730	9	5	15
Independent	4601	0.373	0.0510	0.333	0.286	0.571
Balance	4601	9.362	15.66	3.857	1.004	151.1
TOP1	4601	35.40	14.60	33.55	8.448	79.04
Dual	4601	0.251	0.434	0	0	1

Table 4 Results of univariate tests dividing by receiving EP or not

Variable	Penalty=0			Penalty=1			Mean Difference	Chi ²
	N	Mean	Median	N	Mean	Median		
CER	3505	8.640	8.000	1096	11.274	11.000	-2.633***	159.590***
Media	3505	4.464	4.564	1096	4.726	4.852	-0.263***	48.207***

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$.

Table 5 Results of univariate tests dividing by media coverage

Variable	Low media coverage			High media coverage			Mean Difference	Chi ²
	N	Mean	Median	N	Mean	Median		
CER	2309	8.680	8	2292	9.860	9	-1.180***	37.741***
Penalty	2309	0.196	0	2292	0.281	0	-0.085***	46.035***
Penalty_count	2309	0.969	0	2292	2.143	0	-1.174***	46.035***

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$.

Table 6 Results of univariate tests dividing by political connections

Variable	PC=0			PC=1			Mean Difference	Chi ²
	N	Mean	Median	N	Mean	Median		
CER	3119	9.298	8	1482	9.202	8	0.096	0.006
Penalty	3119	0.270	0	1482	0.171	0	0.099***	53.789***
Penalty_count	3119	1.703	0	1482	1.239	0	0.465***	53.789***

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$.

Table 7 Results of univariate tests dividing by industry competition

Variable	High industry competition			Low industry competition			Mean Difference	Chi ²
	N	Mean	Median	N	Mean	Median		
CER	2351	8.841	8	2250	9.713	9	-0.872***	6.033**
Penalty	2351	0.186	0	2250	0.292	0	-0.106***	71.376***
Penalty_count	2351	0.866	0	2250	2.272	0	-1.406***	71.376***

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$.

Table 8 Correlation relationships of main variables

Variable	CER	Penalty	Penalty_count	Media	PC	HHI
CER	1					
Penalty	0.239***	1				
Penalty_count	0.224***	0.600***	1			
Media	0.075***	0.108***	0.141***	1		
PC	-0.010	-0.108***	-0.047***	0.050***	1	
HHI	0.068***	0.136***	0.184***	0.062***	-0.042***	1

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$.

Table 9 The impact of EP on CER

Variable	(1) CER _{t+1}	(2) CER _{t+1}
Penalty	0.806*** (4.493)	
Penalty_count		0.055*** (3.461)
Asset	1.210*** (17.984)	1.226*** (17.817)
LEV	-0.358 (-0.846)	-0.293 (-0.691)
EstAge	-0.274 (-1.188)	-0.138 (-0.602)
Growth	-0.007*** (-2.788)	-0.007*** (-2.906)
ROA	0.011 (0.654)	0.011 (0.666)
Cashflow	5.202*** (4.554)	5.269*** (4.622)
Cost	-4.028*** (-3.451)	-4.111*** (-3.508)
Board	0.257*** (5.390)	0.256*** (5.364)
Independent	0.548 (0.399)	0.507 (0.368)
Balance	0.012** (2.328)	0.013** (2.546)
TOP1	0.001 (0.290)	0.001 (0.234)
Dual	-0.151 (-1.057)	-0.170 (-1.192)
_cons	-19.987*** (-11.723)	-20.623*** (-11.974)
Industry FE	Yes	Yes
Year FE	Yes	Yes
<i>N</i>	4601	4601
R2	0.220	0.219
Adj. R2	0.216	0.215
F	66.699	67.078

Note: *t* statistics in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 10 The moderating effects

Variable	(1) CER _{t+1}	(2) CER _{t+1}	(3) CER _{t+1}	(4) CER _{t+1}	(5) CER _{t+1}	(6) CER _{t+1}
Penalty	0.726*** (4.061)		0.756*** (4.210)		0.924*** (5.054)	
Penalty count		0.028 (1.606)		0.055*** (3.469)		0.054*** (3.338)
Media	0.180** (2.577)	0.183*** (2.627)				
Penalty*Media	0.617*** (4.326)					
Penalty count*Media		0.041*** (3.517)				
PC			0.337** (2.497)	0.329** (2.453)		
Penalty*PC			-1.279*** (-3.715)			
Penalty count*PC				-0.066** (-2.331)		
HHI					-2.438*** (-2.777)	-1.648* (-1.774)
Penalty*HHI					4.946*** (3.448)	
Penalty count*HHI						0.100 (0.947)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	4601	4601	4601	4601	4601	4601
R2	0.225	0.221	0.224	0.221	0.223	0.219
Adj. R2	0.221	0.217	0.220	0.216	0.219	0.215
F	63.716	63.855	63.335	61.191	62.378	62.104

Note: *t* statistics in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 11 Regression results of endogeneity issues

Variable	(1) Penalty	(2) CER _{t+1}	(3) CER _{t+1}	(4) CER _{t+1}	(5) CER _{t+1}
MeanPenalty1	0.077*** (3.909)				
MeanPenalty2	0.087*** (5.574)				
Penalty		0.822*** (4.579)		0.938*** (3.676)	
Penalty_count			0.055*** (3.414)		0.072** (2.440)
IMR		1.197*** (2.593)	1.074** (2.320)		
Control variables	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	4601	4601	4601	1169	1169
R2		0.221	0.219	0.212	0.207
Pseudo R2/Adj. R2	0.303	0.217	0.216	0.197	0.192
F		64.374	64.561	18.501	18.043

Note: *t* statistics in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 12 Results of other robustness checks

Variable	New proxy for independent variable	New proxy for dependent variable		Ordered Logit model	
	(1) CER _{t+1}	(2) Ind_CER _{t+1}	(3) Ind_CER _{t+1}	(4) CER _{t+1}	(5) CER _{t+1}
Penalty_degree	0.022*** (2.853)				
Penalty		0.559*** (3.164)		0.365*** (4.890)	
Penalty_count			0.040** (2.559)		0.026*** (4.164)
Control variables	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
<i>N</i>	4601	4601	4601	4601	4601
R2	0.218	0.124	0.123		
Adj. R2/Pseudo R2	0.214	0.120	0.119	0.043	0.042
F	66.578	31.457	31.621		

Note: *t* statistics in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 13 Regression results of additional analysis

Variable	(1) CER _{t+2}	(2) CER _{t+2}	(3) CER_Symbolic _{t+1}	(4) CER_Substantive _{t+1}	(5) CER_symbolic	(6) CER_substantive _{t+1}
Penalty	0.884*** (4.401)		0.318*** (5.057)	0.497*** (3.699)		
Penalty		0.061*** (3.722)			0.012** (2.277)	0.043*** (3.505)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	3563	3563	4601	4601	4601	4601
R2	0.215	0.213	0.239	0.171	0.235	0.171
Adj. R2	0.210	0.209	0.235	0.167	0.232	0.167
F	53.806	54.555	75.504	46.992	75.019	47.558

Note: *t* statistics in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 14 The results of what hypotheses have been validated

Hypotheses	Results
H1 (EPs→CER)	Supported
H2 (Moderating role of media coverage)	Supported
H3 (Moderating role of political connections)	Supported
H4 (Moderating role of industry competition)	Not supported

Appendix I The classification of CER actions

Dimensions	Indicators	Types of CER actions
Environmental governance responsibility	Whether the firm carries out the emission reductions and treatments of waste gas	Substantive actions
	Whether the firm carries out the emission reductions and treatments of waste water	
	Whether the firm carries out the emission reductions and treatments of soot and dust	
	Whether the firm carries out the utilization and treatments of solid waste	
	Whether the firm deals with the pollution from noise, light and radiation	
	Whether the firm implements clean production	
Environmental supervision responsibility	Whether the firm is the national key supervision unit	
	Whether the firm has any major environmental pollution incidents	
	Whether the firm has any environmental petition events	
	Whether the firm meets the emission standard of pollutant discharges	
	Whether the firm certifies ISO 14001	
	Whether the firm certifies ISO 9001	
Environmental management responsibility	Whether the firm participates in public welfare activities, especially environmental protection activities	Symbolic actions
	Whether the firm receives environmental protection awards	
	Whether the firm has environmental protection concept, environmental policy, environmental management organization, circular economy development mode, green development and other related environmental contents	
	Whether the firm discloses the achievements of past environmental goals and clarifies future environmental goals	
	Whether the firm formulates a series of rules and regulations related to environmental management systems	
	Whether the firm carries out education and training on environmental protection for employees	
	Whether the firm establishes an emergency mechanism for major environmental incidents	
Whether the firm implements the "three simultaneous" system		