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Political connections and corporate environmental protection-related investment: setting a benchmark or shrinking back?

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ABSTRACT

Protecting environment has become a vital responsibility for corporations. Based on manually collected data of China's A-share listed companies from 2010 to 2017, this study investigates the effect of corporate political connections (PCs) on corporate environmental protection-related investment (EPI). Our findings suggest that PCs negatively influence firms' EPI. Specifically, the more politically connected top executives are hired or the higher the political hierarchy of such executives, the lower would be the firm's EPI. We further find that the negative influence on EPI originates from the executives-related PCs compared with directors-related PCs. Additional tests first reveal that firms' EPI fails to prompt up corporate value. Second, the establishment of committees under the board could alleviate the negative influence of PCs on EPI. Finally, government regulation mitigates the negative effects of PCs on EPI.

KEYWORDS

Political connections; environmental protection-related investment; government environmental regulations

1. Introduction

Harmonious economic progress and environmental protection has always been and will remain of vital importance, politically and economically, across the world. Since 1978, when China's 'Opening Up' policy was implemented, the Chinese economy has grown rapidly and has now become the second biggest economy in the world; however, the negative externalities of such rapid growth on the environment have been severe. Severe smog is reported in many places in China.¹ During recent years, the Chinese government has expressed an unprecedented focus on the construction of an ecological civilisation. At the 18th National Congress of the Communist Party of China (CPC), officials initially proposed to 'construct a more beautiful China' and incorporate an ecological civilisation into the overall five-pronged strategy for building socialism with Chinese characteristics,

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¹Report on 5 January 2017, from Xinhua News Agency, 'Smog surrounded in many places for days, and environmental inspections still found illegal sewage discharge', website: <http://www.kankanews.com/a/2017-01-05/0037834284.shtml>;

Report on 12 November 2015, "Smog Week in Many North China: Who is the culprit? how to respond?", website: <http://www.kankanews.com/a/2015-11-12/0037219959.shtml>.

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that is, to promote coordinated progress in economic, political, cultural, social, and ecological areas. President Xi even posited the notion that ‘lucid waters and lush mountains are invaluable assets.’ As significant micro units of the economy and society, public firms should take responsibility to promote sustainable development and to defend our ‘lucid waters and lush mountains.’

Among various investment decisions, environmental protection-related investment (EPI) plays a significant role. In addition, it is also an important route through which corporations undertake the responsibility of environmental protection. Existing literature documents that certain factors influence EPI, such as firm size (Hayami, 1984; Hussey & Eagan, 2007; Welch et al., 2002), financial conditions, industry (Tang et al., 2013), government regulations (Wang et al., 2017; Xue & Yi, 2015; Yuan & Geng, 2010), and public supervision (Wang et al., 2017). Corporations were originally motivated to invest in environmental protection. On the one hand, it is due to regulated pressure, and on the other, firms could acquire a competitive edge by investing in environmental protection (Gray & Deily, 1996; Porter & Kramer, 2011; Yuan & Geng, 2010). However, under the specific institutional circumstances of China, the government plays a crucial role in the market and exerts great impact on corporate behaviour. Therefore, how does the government–business relationship in China affect corporate environmental protection-related investment? Would the effect varies with different types of corporate political connections (PCs), established either by directors or executives?

This study intends to explore the effect of corporate PCs on firms’ EPI. We employ China’s A-share listed firms from 2010 to 2016 as our sample and manually collect EPI data from corporate disclosure archives, including the environmental responsibility undertaken reports, sustainability reports, social responsibilities undertaken reports, and other annual reports. We present several findings. First, PCs negatively influence firms’ EPI. Specifically, the more politically connected top executives are hired or the higher the political hierarchy of such executives, the lower would be the firm’s EPI. By categorising the PCs into executive-related and director-related PCs, we further find that the negative influence originates from the former type of PCs. Our additional test results reveal that board committees will elevate the aforementioned negative effects. In addition, firms’ EPI fails to increase corporate value in the market. Finally, at the 18th and 19th National Congress, the CPC and President Xi emphasised the concept of ‘lucid waters and lush mountains are invaluable assets.’ We consider the proposal of this concept as a signal of official regulation and test its mitigation effect. The results suggest that government regulation mitigates the negative effects of PCs on EPI. Specifically, we also note that pollution regulation exerts a more significant mitigation effect than legal regulation.

Our study makes several contributions to the literature. First, EPI is an important aspect of corporate social responsibility (CSR). Considering the current policy circumstances, where President Xi and China’s central government have emphasised that ‘lucid waters and lush mountains are invaluable assets.,’ and the business circumstances, where corporations undertake social responsibilities, we combine the most important relationship among market participants: the government–corporation relationship with EPI, which is not only aligned with mainstream ideology in Chinese society but also an expansion of existing research focusing on the government–business relationship. Second, by combining internal governance factors and external institutional factors, we complement the existing literature by demonstrating the interaction of institutional factors and corporate

fundamental factors that interact with environmental protection practices. Finally, we include strategy-selection theory, Porter's hypothesis, imprinting theory, and theory of path-dependence into our analysis to offer a new perspective in explaining the negative effect of PCs on EPI.

The remainder of this paper is organised as follows. [Section 2](#) introduces theories and hypotheses development. [Section 3](#) describes the research design. [Section 4](#) provides the empirical results. [Section 5](#) offers additional analyses, and [Section 6](#) concludes the paper.

2. Theory and hypotheses development

2.1. *Corporate political connections (PCs) and environmental protection-related investment (EPI)*

Environmental protection responsibility is a significant part of CSR. According to the strategy-selection theory, CSR is considered a long-run strategy because fulfilling social responsibilities can achieve competitive advantage, reputation, and strategic benefits (Martin & Moser, 2016; Porter & Kramer, 2011). Porter's hypothesis also proposes that although EPI increases costs, technological innovation in pollution control can offset this cost, thereby achieving a win-win situation in terms of profits and environment protection (Porter & Kramer, 2011). However, the increasing severity of environmental problems will damage the operation of the macro economy in the long run, making microeconomic entities unable to enjoy economic benefits in the long run. The negative externalities of environmental contamination lead to deviations between private and social costs, making the allocation of market resources fall short of the Pareto-efficiency (Pigou, 1920). Recent studies on air pollution also demonstrate that environmental pollution such as smog significantly reduces the quality of China's economic development, and this negative externality would become stronger with time passes by (Chen & Chen, 2018). Therefore, companies need external supervisions to compel them to fulfil their environmental protection responsibilities. The government regulates the performance of corporate environmental protection responsibilities through natural resources exploration, pollution control, and other aspects pertaining to environmental protection. Companies invest in environmental protection to comply with the regulations (Gray & Deily, 1996; Yuan & Geng, 2010). The stricter the government environmental protection regulations, the higher is the investment in environmental protection (Wang et al., 2017; Xue & Yi, 2015). Firms in industries with severe polluting emissions face a higher risk of penalties than other firms because they draw greater attention from both the government and society and would be expected to invest more in environmental protection (Tang et al., 2013).

In China, the government intervenes in many aspects of the market (Pan & Yu, 2011; Shleifer & Vishny, 1994, 1997, 1998; Yu & Pan, 2008). The 'Twelfth Five-Year Plan of National Environmental Protection' clearly includes environmental protection as an important indicator of local officials' performance and implements a one-vote veto system for local environmental protection. These requirements link the appointment, assessment, and promotion of local officials at all ranks to the environmental protection condition of their jurisdictions. Therefore, local officials have an incentive to motivate local companies to undertake environmental protection projects for their political promotion, and this exerts external pressure on companies and compels companies to actively carry out

pollution control and other environmental protection actions (Ma & Tang, 2018). This effect is more pronounced in companies with PCs (Zhang et al., 2019). Thus, PCs would encourage corporations to invest in environmental protection. From the perspective of the corporations, political associations, as an important informal institution, bring considerable 'resource effects.' Existing literature documents that politically connected companies have lower financial constraints (Claessens et al., 2008; Dinç, 2005; Fan et al., 2008; Johnson & Mitton, 2003; Lian et al., 2011; Yu & Pan, 2008) and easier access to government subsidies (Faccio, 2006; Yu et al., 2010). These 'resource effects' offer the politically connected firms enough cash flow, which in turn allows them to invest more in environmental protection. Based on the above analysis, our first testable hypothesis is:

H1a: Political connections positively influence the corporate environmental protection-related investment.

However, some studies show that PCs also exert negative effects such as over-investment, excess personnel, increased compensation expenses, and reduced innovation capabilities (Faccio, 2006; Fan et al., 2014; Liang & Feng, 2010; Yuan et al., 2015; Zhang et al., 2010). Therefore, it is reasonable to expect that PCs may negatively influence corporate EPI.

First, based on imprinting theory, in China, people with a political background and experience generally come from government-control institutions, such as the public services sector. The imprint formed during the work has an important impact on the future behaviour and decision-making of a person. These people always lack special skills, but they know they can gain 'resource access' by maintaining close ties with the government in a transitional economy (Dai et al., 2016). Therefore, politically connected corporations pay more attention to the maintenance of government-business relations in the management process because of the imprints formed by politically connected executives and directors. However, maintaining a relationship with the government requires a substantial investment. In the long run, resource constraints would lead to insufficient investment in developing the core capacity of the corporation (Yang et al., 2011), let alone investing in projects with long payback periods, such as environmental protection.

Second, theories of institutional economics and corporate governance demonstrate that factors such as institutional background would affect the choice of the paths of corporate governance. The higher the return from a certain path, the more likely that the subject will choose that path for a long time and consequently form path dependency. Politically connected firms exhibit the stigma of 'paying attention to the regulations of higher rank of the government', because they hire executives or directors with political backgrounds who well understand the political aspirations of the local officials. In addition, the long-run reciprocal behaviour between politically connected firms and local governments enables firms to enjoy various resources and conveniences, thus forming path dependency. The expectations of enhancing the political performance of local officials compel the associated companies to focus on projects with short payback periods. The payback period of EPI is long and uncertain, and the benefit is not likely to be achieved within the tenure of the current officials. Therefore, under the resource constraints, the associated companies are expected to choose more realistic and short-run goals at the cost of abandoning long-run social and environmentally beneficial goals, thereby cutting the EPI. Since 2010, the central government of China has included

environmental performance-related assessments in the performance evaluation of local officials and has implemented a one-vote veto. However, opaque and manipulated environmental data continues to demotivate local officials to make concrete efforts in protecting the environment (Ghanem & Zhang, 2013; Zhang et al., 2019).²

In addition, for politically connected firms, the cost of violations is relatively low (Xu, Qian et al., 2013; Correia, 2014). Compared with non-politically connected firms of similar size, the same EPI by politically connected firms is less likely to receive the attention of authorities. When facing environmental protection inspections, the access to information in advance enables politically connected companies to be well prepared for inspection. Even if a politically connected firm is caught in a violation, it can reduce or even eliminate the impact of severe violations through its political ties. Even if it has to be punished, such firms are less likely to be punished heavily. Therefore, the cost of violations is lower than the cost of EPI, and thus, rational and profit-seeking firms with political ties are more willing to bear the cost of violations rather than the higher costs of environmental protection. Based on the above analysis, we propose the following hypothesis:

H1b: Political connections negatively influence the corporate environmental protection-related investment.

2.2. Different effects between executive-type PCs and director-type PCs on EPI

In corporate governance, the roles of executives and directors differ. Executives mainly implement the decisions from the board of directors and directly participate in the company's operations, and hence, they have information advantages. Bennedsen et al. (2020), using CEO data, demonstrate that CEOs are unique and have an important influence on firms' profitability and investment decisions. According to agency theory, hiring top executives increases the first type of agency costs, or even dilutes control, but hiring directors does not do so. Companies can establish PCs by hiring senior executives or directors with political backgrounds. Existing literature documents the difference between the PCs of executives and that of directors (Tang & Lin, 2016). Therefore, when corporations establish political ties through directors or executives, which type of PCs exert a more significant influence on EPI?

First, as core members of corporate governance, executives play an important role in strategic and business decisions. Politically connected executives not only make important decisions but also connect political institutions, so their influence on the development of corporations is profound. Studies have demonstrated that politically connected senior managers can help firms to reduce the cost of violations (Correia, 2014; Xu, Qian et al., 2013). The political ties they establish can prevent their firms from being severely punished when rules are broken. Even if those firms are punished, the punishment is delayed and less serious. Politically connected executives are always associated with high and positive management expenses, which reflects the rent-seeking (Du et al., 2011). As a result, politically connected executives are

²Report on 6 August 2018, from Phoenix.com, 'Interview with the Ministry of Environment: Mayor of Shanxi Linfen Falsified Monitoring Data', URL: http://finance.ifeng.com/a/20180806/16430421_0.shtml; Report on 25 October 2016, from Sina News, 'A number of officials in Xi'an were taken away wearing "masks" for air samplers', URL: <https://news.sina.com.cn/o/2016-10-25/doc-ixwzuci9464182.shtml>.

responsible for communicating with the government regarding corporate affairs, which directly influences the direction of the corporation. Nevertheless, directors accept the entrustment of shareholders to provide supervision and consultation to the company (Hillman & Dalziel, 2003). In China, the Company Law of People's Republic of China also specifies that the board of directors decides the investment plans for a firm, and hence, EPI is inseparable from the directors. The main purpose of hiring directors with political backgrounds is to improve reputation or increase economic benefits for the firm (Tang & Lin, 2016), not to optimise the firm's decision-making. Studies also show that politically connected directors can help companies break the high barriers of some industries, and can reduce financing costs (Houston et al., 2014).

Corporate EPI includes revenue expenditure and capital expenditure. Revenue expenditure includes the operating expenses of environmental protection facilities, environmental taxes, and pollution control, which are usually determined by the production and operation conditions and are decided by corporate executives. Capital expenditure includes the R&D of environmental technologies and the purchase and renovation of environmental facilities (Tang et al., 2013). When investment is below a certain limit, the executives can make their own decisions, but when investment exceeds a certain limit, the executives are required to report to the board of directors for review and approval (Liu et al., 2015). The board of directors exercises its decision-making power at the board meetings. The annual meetings are held several times a year, so independent directors may not be able to attend meetings due to their busy schedule (Ma & Shi, 2014), and thus, their decision-making and supervisory functions are adversely affected. At the same time, grey directors weaken the monitoring function of the board of directors (Lee & Persson, 2009; Subrahmanyam, 2008). Therefore, corporate PCs formed from politically connected executives more significantly influence EPI than PCs formed through politically connected directors do. Based on the above analysis, we propose the following hypotheses:

H2a: Compared to director-type PCs, executive-type PCs have a more significant positive effect on EPI.

H2a: Compared to director-type PCs, executive-type PCs have a more significant negative effect on EPI.

3. Research design

3.1. Sample selection and data source

We use data from China's A-share listed companies on the Shanghai Stock Exchange and the Shenzhen Stock Exchanges from 2010 to 2017 as our sample. Since the Ministry of Environmental Protection issued the 'Guidelines for Environmental Information Disclosure of Listed Companies' (draft for comments) in 2010, listed companies in 16 categories of heavy pollution industries are required to publish annual environmental reports. Hence, our sample began in 2010.

We manually collect EPI data from the following corporate disclosures: environmental protection reports, sustainability reports, social responsibility reports, and annual reports. We then manually collect government environmental regulation data from 'China's

Environment Yearbook' We filter our sample by the following steps: (1) We exclude firms in the finance and insurance industries because those firms' capital structures are different from those in other industries. (2) We exclude firms with missing financial data and corporate governance data. Finally, we obtain 910 firm-year observations. The financial, corporate governance, and political connection data are collected from the China Stock Market & Accounting Research Database (CSMAR). All continuous variables are winsorised at the 1% and 99% levels.

3.2. Empirical models and measurement of key variables

We use the following multiple regression model to examine H1:

$$Envirp_{i,t} = \alpha + \beta_0 Pc_{i,t} + \beta_1 \sum Controls_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $Envirp_{i,t}$ is the annual EPI amount of firm i . According to environmental protection reports, sustainability reports, social responsibility reports, and annual reports disclosed by our sample firms, we use the EPI amount plus '1' and take the natural logarithm. $Pc_{i,t}$ is the PCs variable, and we use the PCs of executives to proxy a firm's PCs. This variable includes Mpc_rat and Mpc_level . Mpc_rat is the ratio of the number of politically connected executives to the total number of executives; Mpc_level is the highest political rank of a firm's politically connected executives.

The set of control variables include firm size ($Size$), financial leverage (Lev), return on equity (Roe), the percentage of ownership by the largest shareholders ($Top1$), sales growth ($Growth$), free cash flow (Fcf), percentage of independent directors to total directors on the board ($Outrat$), the size of the board ($Boardsize$), and ownership status (Soe). We also control the industry (Ind) and year ($Year$) fixed effects.

We use Equation (2) to test H2:

$$Envirp_{i,t} = \alpha + \beta_0 Mpc_{i,t} + \beta_1 Bpc_{i,t} + \beta_2 \sum Controls_{i,t} + \varepsilon_{i,t} \quad (2)$$

where Mpc is the executive-type PC, including Mpc_rat and Mpc_level , Bpc is the director-type PCs, including Bpc_rat and Bpc_level . Other variables in Equation (2) are the same as those in Equation (1). Table 1 presents the detailed definitions of the variables in Equations (1) and (2).

3.3. Descriptive statistics

Table 2 shows the descriptive statistics of the main variables. The mean values of $Envirp$, $Size$, Lev , Roe , Fcf , and $Top1$ are close to the median, indicating that the sample tends to be normally distributed in terms of basic characteristics. The mean values of Mpc_rat and Bpc_rat were 4.236% and 18.17%, respectively. The mean values of Mpc_level and Bpc_level are 0.446 and 1.419, respectively, and the medians are, respectively, 0 and 1. The 95th quantile is 3, indicating that over half of the sample firms' executives are not politically connected, and over half of the sample firms' directors are politically connected. The proportion and rank of politically connected directors are higher than those of politically connected executives.

Table 3 presents the Pearson and Spearman correlation coefficients of the main variables. Among PCs variables, the executive-type PCs variable (Mpc_rat) is negatively

Table 1. Variable definitions.

Variables	Definitions
<i>Envirp</i>	A firm's annual EPI amount plus '1' and take the natural logarithm.
<i>Pc</i>	A firm's political connections, using the PCs of executives to proxy a firm's PCs, including <i>Mpc_rat</i> and <i>Mpc_level</i>
<i>Mpc_rat</i>	The ratio of the number of politically connected executives to the number of total executives.
<i>Bpc_rat</i>	The ratio of the number of politically connected directors to the number of total directors on the board.
<i>Mpc_level</i>	The highest political rank of a firm's PC executives. '3' for the national hierarchy, '2' for the provincial hierarchy, '1' for the departmental, municipal, and other hierarchies, '0' for none.
<i>Bpc_level</i>	The highest political rank of a firm's PC directors. '3' for the national hierarchy, '2' for the provincial hierarchy, '1' for the departmental, municipal, and other hierarchies, and '0' for none.
<i>Size</i>	The natural log of total asset of a sample firm
<i>Lev</i>	The book value of the firm's total liabilities divided by the book value of its assets.
<i>Roe</i>	Return on equity
<i>Growth</i>	Sales growth rate
<i>Fcf</i>	The ratio of net cash flow from operating activities to the total assets at the end of the period
<i>Top1</i>	The percent of ownership by the largest shareholder
<i>Outrat</i>	The ratio of independent directors to the total directors on the board
<i>Boardsize</i>	The total number of directors in a sample firm
<i>Soe</i>	A corporate nature dummy, which equals 1 if the ultimate owner is the government or other state-owned enterprise, and 0 otherwise.

correlated with EPI (*Envirp*) and is significant at 1%, while director-type PCs are not significantly correlated with EPI, indicating that executive-type PCs have a more pronounced effect on EPI. Most of the correlations are under 0.5, indicating that there is no severe multicollinearity problem existing.

4. Empirical results

4.1. PCs and corporate EPI

Table 4 presents the regression results from Equation (1) to test H1. In columns (1) and (2), the coefficients of *Mpc_rat* are negative and significant at the 1% level, suggesting that the higher the proportion of politically connected executives, the lower is the company's EPI. In columns (3) and (4), the coefficients of *Mpc_level* are negative and significant at the 1% level, suggesting that the higher the level of politically connected executives, the lower is the company's EPI. Therefore, it proves that corporate political connection has an

Table 2. Descriptive statistics.

Variables	N	Mean	P50	std	P25	P95
<i>Envirp</i>	910	8.008	8.11	1.982	6.649	11.25
<i>Mpc_rat</i>	910	4.236	0	9.316	0	25
<i>Bpc_rat</i>	910	18.17	11.11	19.79	0	55.56
<i>Mpc_level</i>	910	0.446	0	0.946	0	3
<i>Bpc_level</i>	910	1.419	1	1.332	0	3
<i>Size</i>	910	13.96	13.83	1.576	12.8	16.88
<i>Lev</i>	910	49.21	50.4	18.86	35.45	79.03
<i>Roe</i>	910	6.974	7.2	10.98	2.818	21.92
<i>Growth</i>	910	13.4	8.53	30.07	-0.456	56.31
<i>Fcf</i>	910	5.818	5.687	6.527	2.148	16.78
<i>Top1</i>	910	39.73	39.81	16.6	27.95	68.89
<i>Outrat</i>	910	37.45	33.33	6.174	33.33	50
<i>Boardsize</i>	910	9.305	9	2.102	8	14
<i>Soe</i>	910	0.597	1	0.491	0	1

Table 4. Empirical results of politically connected corporate and environmental investment.

	(1)	(2)	(3)	(4)
	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>
<i>Mpc_rat</i>	-0.0325*** (-5.44)	-0.0280*** (-4.55)		
<i>Mpc_level</i>			-0.3189*** (-5.32)	-0.3098*** (-5.01)
<i>Size</i>	0.6345*** (13.84)	0.7621*** (15.65)	0.6489*** (14.01)	0.7856*** (15.93)
<i>Lev</i>	0.0037 (1.03)	0.0079** (2.16)	0.0034 (0.96)	0.0079** (2.18)
<i>Roe</i>	-0.0078 (-1.34)	-0.0088 (-1.54)	-0.0079 (-1.37)	-0.0086 (-1.51)
<i>Growth</i>	0.0024 (1.28)	0.0009 (0.49)	0.0028 (1.48)	0.0013 (0.69)
<i>Fcf</i>	0.0451*** (4.87)	0.0339*** (3.75)	0.0462*** (4.98)	0.0345*** (3.83)
<i>Top1</i>	0.0003 (0.08)	0.0038 (1.06)	0.0008 (0.22)	0.0043 (1.21)
<i>Outrat</i>	-0.0114 (-1.13)	0.0002 (0.02)	-0.0116 (-1.15)	0.0015 (0.15)
<i>Boardsize</i>	-0.0248 (-0.82)	-0.0387 (-1.31)	-0.0144 (-0.47)	-0.0307 (-1.04)
<i>Soe</i>	0.193 (1.58)	0.1578 (1.32)	0.2024* (1.66)	0.1575 (1.33)
<i>_Cons</i>	-0.6026 (-0.97)	-2.1195 (-1.22)	-0.9139 (-1.45)	-2.5609 (-1.48)
<i>Ind/Year</i>	No	Yes	No	Yes
<i>N</i>	910	910	910	910
<i>adj. R-sq</i>	0.308	0.383	0.307	0.386

t statistics in parentheses.

* p < 0.1, ** p < 0.05, ***p < 0.01.

inhibitory effect on EPI and supports H1. These results are consistent with those of Yuan et al. (2015).

The coefficient of the control variable *Size* is positive and significant at the 1% level, indicating that the larger the firm, the higher the firm's EPI, which is consistent with Hayami (1984), Welch et al. (2002), Hussey and Eagan (2007), and Wang et al. (2017). The coefficient of *Fcf*, as expected, is positive and significant at the 1% level, meaning the greater the free cash flow, the higher the corporate EPI, which is in line with the conclusions of Richardson (2006), Cheng et al. (2008), and Zhong et al. (2010) and Xu, Qian et al. (2013).

4.2. PCs and EPI: tests of Heterogeneous political connections

Table 5 presents the regression results used to test H2. We first add *Bpc_rat* and *Bpc_level* into Equation (1), and the results are shown in columns (1) and (4). The coefficient of *Bpc_rat* is -0.0086, which is significant at the 5% level; the coefficient of *Bpc_level* is -0.1076, which is significant at the 10% level, suggesting that the higher the proportion of politically connected directors, the higher the level of political connection, and the lower is the corporate EPI. We then include *Mpc_rat* and *Mpc_level* into Equation (1), and the results are shown in columns (2) and (5). Finally, we introduce *Bpc_rat*, *Mpc_rat*, *Bpc_level*, and *Mpc_level* into Equation (2). In column (3), the coefficient of *Mpc_rat* is significant at the 1% level, while the coefficient of *Bpc_rat* is no longer significant. In column (6), the coefficient of *Mpc_level* is significant at the 1% level, and the coefficient of *Bpc_level* is no

Table 5. Executives' vs. directors' political connections and EPI.

	(1)	(2)	(3)	(4)	(5)	(6)
	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>
<i>Bpc_rat</i>	-0.0086** (-2.30)		-0.0014 (-0.34)			
<i>Mpc_rat</i>		-0.0280*** (-4.55)	-0.0270*** (-3.92)			
<i>Bpc_level</i>				-0.1076* (-1.79)		-0.0265 (-0.43)
<i>Mpc_level</i>					-0.3098*** (-5.01)	-0.3021*** (-4.69)
<i>Size</i>	0.7542*** (15.20)	0.7621*** (15.65)	0.7646*** (15.52)	0.7405*** (15.13)	0.7856*** (15.93)	0.7863*** (15.93)
<i>Lev</i>	0.0089** (2.42)	0.0079** (2.16)	0.0078** (2.14)	0.0093** (2.54)	0.0079** (2.18)	0.0078** (2.15)
<i>Roe</i>	-0.0099* (-1.72)	-0.0088 (-1.54)	-0.0089 (-1.55)	-0.0102* (-1.77)	-0.0086 (-1.51)	-0.0087 (-1.53)
<i>Growth</i>	0.0006 (0.29)	0.0009 (0.49)	0.0009 (0.47)	0.0006 (0.32)	0.0013 (0.69)	0.0013 (0.67)
<i>Fcf</i>	0.0351*** (3.86)	0.0339*** (3.75)	0.0340*** (3.76)	0.0350*** (3.83)	0.0345*** (3.83)	0.0346*** (3.84)
<i>Top1</i>	0.0046 (1.29)	0.0038 (1.06)	0.0038 (1.06)	0.0048 (1.34)	0.0043 (1.21)	0.0043 (1.21)
<i>Outrat</i>	0.0007 (0.07)	0.0002 (0.02)	0.0004 (0.04)	-0.0004 (-0.04)	0.0015 (0.15)	0.0016 (0.16)
<i>Boardsize</i>	-0.0405 (-1.35)	-0.0387 (-1.31)	-0.0395 (-1.33)	-0.0299 (-1.00)	-0.0307 (-1.04)	-0.0298 (-1.01)
<i>Soe</i>	0.1745 (1.45)	0.1578 (1.32)	0.1589 (1.33)	0.1678 (1.39)	0.1575 (1.33)	0.1572 (1.32)
<i>_Cons</i>	-2.0139 (-1.15)	-2.1195 (-1.22)	-2.1088 (-1.21)	-1.9257 (-1.10)	-2.5609 (-1.48)	-2.5135 (-1.44)
<i>Ind/Year</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	910	910	910	910	910	910
<i>adj. R-sq</i>	0.373	0.383	0.383	0.371	0.386	0.386

t statistics in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

longer significant. The above results demonstrate that, ceteris paribus, politically connected executives have a stronger inhibitory effect on EPI than politically connected directors, thus supporting H2.

4.3. Robustness tests

4.3.1. Alternative measures of key variables

To test the robustness of the results of H1, we first replace *Mpc_rat* and *Mpc_level* with the number of politically connected executives (*Mpc_num*) and the dummy variables of whether there is politically connected executive in the firm (*Pc_dummy*). The results are shown in columns (1) and (2) of Table 6. The coefficients of *Mpc_num* and *Pc_dummy* are negative and significant at the 1% level. Second, we replace *Envirp* with the proportion of EPI in assets (*Envirp1*) and the proportion of EPI in revenue (*Envirp2*), and reestimate Equation (1). The results are shown in columns (3)–(6), and the regression coefficients of *Mpc_rat* and *Mpc_level* are negative and significant at the 1% level. Finally, we use alternative measurements of dependent variable and independent variable at the same time. The results in columns (7)–(10) show that the main results still hold.

Table 6. Robustness tests: alternative measures of main variables.

	Alternative measurements of PCs		Alternative measurements of EPI				Alternative measurements of PCs and EPI			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp1</i>	<i>Envirp1</i>	<i>Envirp2</i>	<i>Envirp2</i>	<i>Envirp1</i>	<i>Envirp1</i>	<i>Envirp2</i>	<i>Envirp2</i>
<i>Mpc_num</i>	-0.3565*** (-4.71)						-0.2570*** (-2.73)		-0.3524*** (-2.88)	
<i>Pc_dummy</i>		-0.6294*** (-4.42)						-0.6142*** (-3.49)		-0.8508*** (-3.71)
<i>Mpc_rat</i>			-0.0221*** (-2.89)		-0.0289*** (-2.91)					
<i>Mpc_level</i>				-0.2358*** (-3.08)		-0.3265*** (-3.27)				
<i>Size</i>	0.7834*** (15.85)	0.7756*** (15.74)	-0.1446** (-2.40)	-0.1275** (-2.08)	-0.0993 (-1.26)	-0.0739 (-0.93)	-0.1313** (-2.14)	-0.1258** (-2.07)	-0.0796 (-1.00)	-0.0715 (-0.90)
<i>Lev</i>	0.0077** (2.12)	0.0079** (2.17)	-0.0029 (-0.65)	-0.0029 (-0.64)	0.0032 (0.53)	0.0031 (0.53)	-0.0029 (-0.65)	-0.0033 (-0.72)	0.0031 (0.52)	0.0026 (0.44)
<i>Roe</i>	-0.0083 (-1.45)	-0.0085 (-1.49)	0.0077 (1.09)	0.0078 (1.10)	0.0067 (0.73)	0.0069 (0.75)	0.008 (1.13)	0.0081 (1.15)	0.0072 (0.78)	0.0074 (0.81)
<i>Growth</i>	0.0008 (0.42)	0.0009 (0.48)	0.0096*** (4.14)	0.0099*** (4.26)	0.0015 (0.48)	0.0019 (0.62)	0.0095*** (4.09)	0.0096*** (4.16)	0.0013 (0.44)	0.0015 (0.50)
<i>Fcf</i>	0.0341*** (3.78)	0.0345*** (3.81)	0.0383*** (3.43)	0.0388*** (3.47)	0.0293** (2.01)	0.0300** (2.06)	0.0385*** (3.44)	0.0388*** (3.48)	0.0296** (2.03)	0.0299*** (2.06)
<i>Top1</i>	0.0037 (1.05)	0.004 (1.12)	0.0004 (0.09)	0.0008 (0.18)	-0.0112* (-1.96)	-0.0107* (-1.88)	0.0004 (0.09)	0.0004 (0.09)	-0.0112* (-1.96)	-0.0113** (-1.98)
<i>Outrat</i>	0.0005 (0.04)	0.0005 (0.05)	0.0055 (0.44)	0.0065 (0.52)	0.0086 (0.53)	0.01 (0.62)	0.0056 (0.45)	0.0061 (0.49)	0.0088 (0.54)	0.0095 (0.58)
<i>Boardsize</i>	-0.0305 (-1.03)	-0.0325 (-1.10)	0.0089 (0.24)	0.0151 (0.41)	0.0503 (1.05)	0.0586 (1.23)	0.0151 (0.41)	0.014 (0.38)	0.0585 (1.23)	0.057 (1.20)
<i>Soe</i>	0.161 (1.35)	0.1387 (1.16)	0.2633* (1.78)	0.2634* (1.79)	-0.1811 (-0.94)	-0.1817 (-0.95)	0.2664* (1.80)	0.2423 (1.64)	-0.1774 (-0.92)	-0.2109 (-1.10)
<i>_Cons</i>	-2.7368 (-1.58)	-2.6288 (-1.52)	2.7985 (1.30)	2.4639 (1.14)	2.2773 (0.81)	1.811 (0.65)	2.5779 (1.20)	2.5575 (1.19)	1.9724 (0.70)	1.9405 (0.69)
<i>Ind/Year</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	910	910	910	910	910	910	910	910	910	910
<i>adj. R-sq</i>	0.384	0.383	0.1	0.101	0.18	0.183	0.099	0.104	0.18	0.185

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

4.3.2. Probit model regression

To make the regression results more robust, we build Equation (3) and use probit regression to test.

$$En_dummy_{i,t} = \alpha + \beta_0 Pc_{i,t} + \beta_1 \sum Controls_{i,t} + \varepsilon_{i,t} \quad (3)$$

where $En_dummy_{i,t}$ is a dummy variable for EPI disclosure to indicate if a company disclosed EPI data in the environmental report, sustainability report, social responsibility report, or annual report. Table 7 presents the regression results; the coefficients of Mpc_rat and Mpc_level are negative and significant at the 1% level.

4.3.3. Endogeneity mitigation

(1) Reverse causality

To mitigate the possible reverse causality on the conclusion, we use the following equation to regress:

$$Envirp_{i,t} = \alpha + \beta_0 Pc_{i,t-n} + \beta_1 \sum Controls_{i,t-n} + \varepsilon_{i,t} \quad (4)$$

We bring Mpc_rat and Mpc_level into Equation (4) and perform regressions lagging 1–3 periods. Table 8 presents the regression results; the coefficients of Mpc_rat and Mpc_level lagging 1–3 periods are all negative and significant at the 1% level. Therefore,

Table 7. Robustness tests: using probit regression model.

	(1)	(2)
	<i>En_dummy</i>	<i>En_dummy</i>
<i>Mpc_rat</i>	-0.0131*** (-8.21)	
<i>Mpc_level</i>		-0.1077*** (-5.90)
<i>Size</i>	0.2516*** (17.04)	0.2475*** (16.88)
<i>Lev</i>	-0.0050*** (-5.11)	-0.0049*** (-5.02)
<i>Roe</i>	-0.0050*** (-3.18)	-0.0050*** (-3.16)
<i>Growth</i>	-0.0007* (-1.76)	-0.0007* (-1.66)
<i>Fcf</i>	0.0167*** (6.71)	0.0167*** (6.76)
<i>Top1</i>	0.0004 (0.39)	0.0005 (0.50)
<i>Outrat</i>	-0.0018 (-0.54)	-0.0019 (-0.56)
<i>Boardsize</i>	-0.0062 (-0.65)	-0.0075 (-0.78)
<i>Soe</i>	0.3220*** (8.93)	0.3262*** (9.08)
<i>_Cons</i>	-4.7873*** (-23.64)	-4.7520*** (-23.62)
<i>Ind/Year</i>	Yes	Yes
<i>N</i>	19,586	19,586
<i>Pseudo R2</i>	0.1015	0.0958

t statistics in parentheses.

* p < 0.1, ** p < 0.05, ***p < 0.01.

Table 8. Robustness tests: reverse causality mitigation.

	One period lagged		Two periods lagged		Three periods lagged	
	(1)	(2)	(3)	(4)	(5)	(6)
	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>
<i>n</i>	1	1	2	2	3	3
<i>Mpc_rat</i> _{<i>t-n</i>}	-0.0291*** (-5.22)		-0.0277*** (-5.12)		-0.0301*** (-5.34)	
<i>Mpc_level</i> _{<i>t-n</i>}		-0.2795*** (-5.04)		-0.2678*** (-4.74)		-0.2726*** (-4.63)
<i>Size</i> _{<i>t-n</i>}	0.8203*** (15.50)	0.8358*** (15.61)	0.8233*** (14.87)	0.8353*** (14.91)	0.8111*** (13.83)	0.8187*** (13.79)
<i>Lev</i> _{<i>t-n</i>}	0.0053 (1.32)	0.0055 (1.36)	0.0042 (1.04)	0.004 (0.97)	0.0057 (1.34)	0.005 (1.16)
<i>Roe</i> _{<i>t-n</i>}	-0.0088 (-1.41)	-0.0084 (-1.35)	-0.0128** (-2.16)	-0.0116* (-1.94)	0.0051 (0.74)	0.0058 (0.83)
<i>Growth</i> _{<i>t-n</i>}	-0.0019 (-1.20)	-0.0016 (-1.00)	-0.0011 (-0.54)	-0.0008 (-0.39)	-0.0016 (-0.81)	-0.0013 (-0.65)
<i>Fcf</i> _{<i>t-n</i>}	0.0275*** (2.86)	0.0282*** (2.93)	0.0310*** (3.01)	0.0298*** (2.90)	0.0132 (1.28)	0.012 (1.16)
<i>Top1</i> _{<i>t-n</i>}	0.0013 (0.35)	0.0016 (0.43)	-0.0011 (-0.30)	-0.0009 (-0.22)	0.0001 (0.02)	0.0002 (0.04)
<i>Outrat</i> _{<i>t-n</i>}	-0.0057 (-0.52)	-0.0046 (-0.41)	-0.0078 (-0.65)	-0.008 (-0.67)	-0.0187 (-1.53)	-0.0192 (-1.56)
<i>Boardsize</i> _{<i>t-n</i>}	-0.0284 (-0.91)	-0.0197 (-0.63)	-0.0102 (-0.31)	-0.001 (-0.03)	-0.0091 (-0.27)	-0.0002 (-0.01)
<i>Soe</i> _{<i>t-n</i>}	-0.0056 (-0.04)	0.0208 (0.17)	-0.1438 (-1.09)	-0.0873 (-0.66)	-0.143 (-1.02)	-0.0491 (-0.35)
<i>_Cons</i> _{<i>t-n</i>}	-1.166 (-0.69)	-1.9981 (-1.18)	-1.8745 (-1.48)	-2.085 (-1.63)	-1.4144 (-1.10)	-1.6119 (-1.24)
<i>Ind/Year</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	756	756	673	673	589	589
<i>adj. R-sq</i>	0.404	0.403	0.405	0.401	0.397	0.389

n in the table is the lag period, taking 1, 2, and 3, respectively.

t statistics in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

our main conclusion is not severely influenced by the reverse causality problem.

(2) Selection bias problem

① Controlling of the self-selection problem of politically connected executives

While a company hires politically connected executives, politically connected executives may also choose to join different companies. To alleviate the problem of self-selection of politically connected executives, we adopt the propensity score matching method (PSM) for matching, constructing a sample group that is as similar as possible to the companies of politically connected and non-politically connected executives, and then re-estimate Equation (1).

We perform logit regression on Equation (5) and estimate the propensity scores for companies with and without politically connected executives.

$$Pc_dummy_{i,t} = \alpha + \beta_0 Indpc_{i,t} + \beta_1 Size_{i,t} + \beta_2 Lev_{i,t} + \beta_3 Roe_{i,t} + \beta_4 Growth_{i,t} + \beta_5 Fcf_{i,t} + \beta_6 Top_{i,t} + \beta_7 Outrat_{i,t} + \beta_8 Boardsize_{i,t} + \beta_9 Soe_{i,t} + V_{i,t} \quad (5)$$

where $Pc_dummy_{i,t}$ is a dummy variable for political connections. When a company has politically connected executives, $Pc_dummy_{i,t}$ takes 1; otherwise, it takes 0. We also use the mean value of the politically connected executives ratio of the sample company in year

t (*Indpc*) as the control variable in Equation (7); other variables are consistent with the previous definitions, and we also control the industry (*Ind*) and year (*Year*) effect. We use the companies with the closest propensity scores and not politically connected as the matching samples. After PSM pairing, the standardised deviation of most variables is less than 5%, and the p-value shows that the t-test results of most variables after matching do not reject the null hypothesis that the treatment and control groups are not systematically different, indicating that the matching effect is good.

We use PSM samples to rerun Equation (1). The results in Table 9 suggest that the conclusions of this study are not affected by politically connected executives' self-selection problem.

② Self-selection bias of environmental protection information disclosure

Sample selection bias may exist, because we select companies disclosing EPI information. To alleviate this problem, we perform twofold tests. The first is using PSM nearest neighbour matching to obtain matched samples. We use Equation (6) and perform a logit regression to obtain the propensity score and perform 1:1 neighbouring matching.

Table 9. Robustness tests: self-selection problem of politically connected executives.

	PSM radius matching		PSM nearest neighbour matching	
	(1)	(2)	(3)	(4)
	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>
<i>Mpc_rat</i>	-0.0262*** (-3.04)		-0.0152*** (-5.66)	
<i>Mpc_level</i>		-0.2222** (-2.49)		-0.1937*** (-5.88)
<i>Size</i>	0.8288*** (6.98)	0.8713*** (7.44)	0.8781*** (32.12)	0.8938*** (32.19)
<i>Lev</i>	0.0038 (0.50)	0.0052 (0.67)	0.0013 (0.73)	0.0011 (0.60)
<i>Roe</i>	-0.0326** (-2.30)	-0.0327** (-2.28)	-0.0055* (-1.94)	-0.0058** (-2.06)
<i>Growth</i>	-0.0012 (-0.33)	-0.0004 (-0.11)	-0.0035*** (-6.13)	-0.0035*** (-6.00)
<i>Fcf</i>	0.0294 (1.59)	0.03 (1.60)	0.0282*** (7.15)	0.0293*** (7.47)
<i>Top1</i>	0.005 (0.72)	0.0055 (0.78)	0.0084*** (3.95)	0.0085*** (4.02)
<i>Outrat</i>	-0.0144 (-0.73)	-0.0089 (-0.44)	-0.0063 (-1.02)	-0.0049 (-0.79)
<i>Boardsize</i>	-0.0776 (-1.50)	-0.0609 (-1.16)	0.0133 (0.72)	0.0166 (0.90)
<i>Soe</i>	0.3155 (1.27)	0.308 (1.23)	0.5877*** (7.82)	0.5778*** (7.69)
<i>_Cons</i>	-5.3468** (-2.38)	-6.1852*** (-2.77)	-5.1807*** (-8.25)	-5.4076*** (-8.58)
<i>Ind/Year</i>	Yes	Yes	Yes	Yes
<i>N</i>	223	223	1884	1884
<i>adj. R-sq</i>	0.432	0.424	0.909	0.909

t statistics in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

$$En_dummy_{i,t} = \alpha + \beta_0 Size_{i,t} + \beta_1 Lev_{i,t} + \beta_2 Roe_{i,t} + \beta_3 Growth_{i,t} + \beta_4 Fcf_{i,t} + \beta_5 Top1_{i,t} + \beta_6 Outrat_{i,t} + \beta_7 Boardsize_{i,t} + \beta_8 Soe_{i,t} + V_{i,t} \quad (6)$$

where $En_dummy_{i,t}$ is a dummy variable for EPI disclosure to indicate if a company disclosed EPI data in the environmental protection reports, sustainability reports, social responsibility reports, or annual reports. After PSM, we obtain 1,884 observations. The regression results of Equation (6) are shown in columns (3) and (4) of Table 9, where the coefficients of Mpc_rat and Pc_level are negative and significant at the 1% level, indicating that even if there is a self-selection problem regarding, it does not affect the main result. Second, we expand our sample. We revise the data of companies that do not disclose information about EPI. Specifically, if the listed companies do not disclose environmental investment before the first disclosure, we regarded it as a sample of missing data. If there is intermittent disclosure after the first disclosure year of a listed company, and if the intermittent period is within 2 years, we consider the undisclosed EPI to be zero. If the intermittent period continues for 3 years or more, we regard the undisclosed year as missing data for prudent consideration. Based on the above, our sample is expanded to 999 firm-year observations. Then, we used the expanded sample to re-estimate Equation (1). The results are shown in Table 10 and indicate that the main conclusion is robust.

(3) Sample selection bias of PCs executives hiring

Table 10. Robustness tests: results of using expanded sample.

	(1)	(2)	(3)	(4)
	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>
<i>Mpc_rat</i>	-0.0396*** (-5.10)	-0.0307*** (-3.76)		
<i>Mpc_level</i>			-0.4742*** (-6.12)	-0.4296*** (-5.29)
<i>Size</i>	0.6786*** (11.40)	0.8160*** (12.57)	0.7092*** (11.87)	0.8567*** (13.11)
<i>Lev</i>	0.0014 (0.31)	0.0069 (1.44)	0.0009 (0.19)	0.0064 (1.35)
<i>Roe</i>	-0.0035 (-0.45)	-0.0048 (-0.62)	-0.0028 (-0.36)	-0.0037 (-0.49)
<i>Growth</i>	-0.0026 (-0.69)	-0.0058 (-1.50)	-0.0028 (-0.74)	-0.0056 (-1.47)
<i>Fcf</i>	0.0565*** (4.78)	0.0464*** (3.94)	0.0577*** (4.91)	0.0470*** (4.02)
<i>Top1</i>	0.0065 (1.38)	0.0107** (2.27)	0.0066 (1.41)	0.0107** (2.29)
<i>Outrat</i>	-0.0046 (-0.34)	0.0076 (0.56)	-0.0049 (-0.38)	0.0089 (0.66)
<i>Boardsize</i>	-0.045 (-1.14)	-0.0566 (-1.44)	-0.0295 (-0.75)	-0.0458 (-1.17)
<i>Soe</i>	-0.0343 (-0.22)	-0.0491 (-0.31)	-0.0204 (-0.13)	-0.0534 (-0.34)
<i>_Cons</i>	-1.6436** (-2.04)	-3.2467 (-1.37)	-2.1493*** (-2.66)	-3.8189 (-1.62)
<i>Ind/Year</i>	No	Yes	No	Yes
<i>N</i>	999	999	999	999
<i>adj. R-sq</i>	0.221	0.273	0.23	0.283

t statistics in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

In state-owned enterprises, the government usually appoints officials with a political background, which is exogenous to an extent, but such appointment is also affected by the internal conditions of the enterprise, which is endogenous to an extent. However, the politically connected executives of private enterprises are self-seeking. The choice is also the result of the enterprise's profit maximisation choices based on the economic environment at the time, which are mainly endogenous. If there are certain endogenous factors that determine both PCs and EPI, then PCs and EPI may simply be a simple pseudo correlation. Further, we cannot collect more samples for research. To solve the influence of sample selection bias on the conclusion, referring to Chen et al. (2011), we adopt the two-stage regression method of Heckman (1979) to eliminate possible endogenous problems. In the first stage of regression, we use the following logistic Equation (7) to predict whether the company is politically connected.

$$\begin{aligned}
 Pc_dummy_{i,t} = & \alpha + \beta_0 Lngdppc_{i,t} + \beta_1 Deficit_{i,t} + \beta_2 unemploy_{i,t} + \\
 & \beta_3 Size_{i,t} + \beta_4 Lev_{i,t} + \beta_5 Roe_{i,t} + \beta_6 Growth_{i,t} + \beta_7 Fcf_{i,t} + \beta_8 Top1_{i,t} + \beta_9 Outrat_{i,t} \\
 & + \beta_{10} Boardsize_{i,t} + \beta_{11} Soe_{i,t} + V_{i,t}
 \end{aligned}
 \tag{7}$$

where $Pc_dummy_{i,t}$ is a dummy variable for political connection. When the company has politically connected executives, $Pc_dummy_{i,t}$ takes 1; otherwise, it takes 0. Drawing on the research of Chen et al. (2011), Tang and Sun (2014), and Du et al. (2011), variables related to the economic development of the province where the company is located are added to the above equation: natural logarithm of per capita GDP ($Lngdppc$), regional fiscal deficit divided by GDP ($Deficit$), and urban registered unemployment rate ($Unemploy$). The above data comes from the website of the China Statistics Bureau. The results are shown in column (1) of Table 10. The more backward the economy, the larger is the firm; the smaller the asset-liability ratio, the more likely it is to have PCs.

From the regression of Equation (7), we obtain the inverse Mills ratio and put it as an independent variable into Equation (1) for the second stage of regression to re-examine the relationship between PCs and EPI. The results are shown in columns (2)–(5) of Table 11. Whether the industry and year effect are controlled, the coefficient of the inverse Mills ratio is significant, indicating that the sample has a selective bias problem. Then, after controlling for this deviation, the coefficients of Mpc_rat and Mpc_level are still negative and significant at the 1% level, which is consistent with the conclusion of this paper.

4.3.4. Controlling firm fixed effects

From the tests above, we do not control for company fixed effects. To eliminate the influence of firm-level factors on the main regression, we control for firm and year fixed effects, and rerun H1 and H2. The results are shown in Table 12. In columns (1) and (2), the coefficients of Mpc_rat and Mpc_level are negative and significant at the 1% level; in columns (4) and (6), Mpc_rat and Mpc_level are negative and significant at least at the 5% level, while the coefficients of Bpc_rat and Bpc_level are not significant, which further supports the previous results.

³This part is added based on the constructive comments of the anonymous reviewers, and we are deeply grateful.

Table 11. Robustness test: Heckman two-stage regression.

	Heckman first stage		Heckman second stage		
	(1)	(2)	(3)	(4)	(5)
	<i>Pc_dummy</i>	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>
<i>Lngdp</i>	-0.0822*** (-2.90)				
<i>Deficit</i>	-0.0299*** (-3.12)				
<i>Unemploy</i>	-0.3560*** (-5.24)				
<i>Mpc_rat</i>		-0.0255*** (-4.42)	-0.0209*** (-3.54)		
<i>Mpc_level</i>				-0.2782*** (-4.67)	-0.2618*** (-4.29)
<i>Mill</i>		0.8839*** (3.75)	0.7648*** (3.22)	0.9228*** (3.96)	0.7688*** (3.26)
<i>Size</i>	0.1904*** (4.44)	0.8043*** (13.83)	0.9191*** (15.19)	0.8256*** (14.22)	0.9427*** (15.58)
<i>Lev</i>	-0.0089*** (-2.66)	-0.0034 (-0.88)	0.0006 (0.14)	-0.0039 (-1.02)	0.0004 (0.11)
<i>Roe</i>	0.0011 (0.21)	-0.0042 (-0.78)	-0.0072 (-1.37)	-0.004 (-0.75)	-0.0069 (-1.32)
<i>Growth</i>	-0.0011 (-0.73)	0.0013 (0.82)	-0.0003 (-0.17)	0.0016 (0.97)	0 (0.02)
<i>Fcf</i>	0.002 (0.24)	0.0431*** (4.86)	0.0337*** (3.90)	0.0440*** (4.97)	0.0343*** (3.99)
<i>Top1</i>	-0.0043 (-1.30)	-0.0009 (-0.25)	0.0018 (0.49)	-0.0006 (-0.15)	0.0021 (0.59)
<i>Outrat</i>	0.0113 (1.24)	-0.0046 (-0.44)	0.0054 (0.52)	-0.0035 (-0.34)	0.0071 (0.69)
<i>Boardsize</i>	0.0107 (0.42)	-0.0092 (-0.31)	-0.0255 (-0.87)	0.0013 (0.04)	-0.0185 (-0.64)
<i>Soe</i>	-0.0989 (-0.89)	0.1206 (1.00)	0.101 (0.85)	0.1266 (1.05)	0.0997 (0.85)
<i>_cons</i>	-1.4707** (-2.16)	-4.1941*** (-3.99)	-7.8523*** (-6.61)	-4.6719*** (-4.48)	-8.3075*** (-7.08)
<i>Ind/Year</i>	No	No	Yes	No	Yes
<i>N</i>	910	910	910	910	910
<i>Pseudo R2</i>	0.0889				
<i>adj. R-sq</i>		0.331	0.401	0.333	0.405

t statistics in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4.3.5. Robustness tests: effect of important positions³

In the corporate governance structure, important positions have a more significant influence on corporate governance, operations, and decision-making than non-essential positions. For example, the most important position on the board is the chairman. The chairman will influence R&D investment, executive compensation, and the sensitivity of salary performance (Pan & Zhang, 2019). Having a party member for a chairman in private firms helps to curb financial fraud (Dai et al., 2017). The most important position in the executive team is the CEO. Bennedsen et al. (2020) use data from Danish executives who were hospitalised and absent from corporate governance and found that compared with other executives, the CEO's hospitalisations had a significant impact on company performance. Therefore, to make the conclusions of this article robust, we group according to whether the chairman or CEO is politically connected and rerun Equation (2). The results are shown in Table 13. In columns (1)–(4), whether the chairman is politically connected or not, the coefficients of *Mpc_rat* and *Mpc_level* are significantly negative; in columns (5)–

Table 12. Robust test: controlling for firm fixed effects.

	<i>Envirp</i>					
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Mpc_rat</i>	-0.0325*** (-3.81)			-0.0307*** (-3.19)		
<i>Mpc_level</i>		-0.3190*** (-3.05)				-0.3155** (-2.49)
<i>Bpc_rat</i>			-0.0095*** (-2.67)	-0.0016 (-0.42)		
<i>Bpc_level</i>					-0.1032** (-2.40)	-0.0057 (-0.09)
<i>Size</i>	0.6354*** (5.94)	0.6498*** (6.15)	0.6209*** (5.56)	0.6365*** (5.94)	0.6058*** (5.38)	0.6494*** (6.11)
<i>Lev</i>	0.0037 (0.57)	0.0035 (0.53)	0.0052 (0.79)	0.0038 (0.58)	0.0055 (0.84)	0.0035 (0.53)
<i>Roe</i>	-0.0078 (-0.96)	-0.008 (-0.97)	-0.0087 (-1.01)	-0.0078 (-0.95)	-0.0093 (-1.09)	-0.008 (-0.97)
<i>Growth</i>	0.0024 (0.91)	0.0028 (1.12)	0.0022 (0.79)	0.0023 (0.86)	0.0023 (0.85)	0.0028 (1.07)
<i>Fcf</i>	0.0452*** (5.65)	0.0463*** (5.89)	0.0464*** (6.06)	0.0453*** (5.63)	0.0468*** (5.99)	0.0463*** (5.83)
<i>Top1</i>	0.0003 (0.04)	0.0008 (0.11)	0.0016 (0.22)	0.0004 (0.06)	0.0015 (0.20)	0.0008 (0.12)
<i>Outrat</i>	-0.0115 (-0.73)	-0.0117 (-0.72)	-0.0129 (-0.77)	-0.0113 (-0.71)	-0.0148 (-0.86)	-0.0117 (-0.72)
<i>Boardsize</i>	-0.0248 (-0.40)	-0.0144 (-0.24)	-0.0234 (-0.36)	-0.0246 (-0.39)	-0.0136 (-0.21)	-0.0139 (-0.23)
<i>Soe</i>	0.1943 (1.18)	0.2037 (1.23)	0.2252 (1.28)	0.1998 (1.20)	0.2127 (1.24)	0.2047 (1.23)
<i>_Cons</i>	-0.6154 (-0.42)	-0.9269 (-0.66)	-0.4825 (-0.31)	-0.6319 (-0.43)	-0.321 (-0.20)	-0.9224 (-0.66)
<i>Stkcd/Year/Ind</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	910	910	910	910	910	910
<i>adj. R-sq</i>	0.308	0.307	0.294	0.307	0.29	0.306

t statistics in parentheses.

* p < 0.1, ** p < 0.05, ***p < 0.01.

(8), whether the CEO is politically connected, the coefficients of *Bpc_rat* and *Bpc_level* are not significant. The above conclusions show that under the premise of considering the cross-effects of important positions, the PCs of executives have a stronger influence on corporate EPI than that of directors' PCs, thus consolidating the conclusions of hypothesis H2b.

5. Additional analyses

5.1. The balancing function of board committees

The effectiveness of the advisory and oversight functions of a board is highly controversial. Some scholars propose that the 'invalid consultation' and 'invalid supervision' hypotheses (Cao & Lin, 2017). This is due to the function of a conference unit of the board of directors (Xie, 2005), that is, the board of directors can only exercise decision-making power when they meet, discuss, and vote on proposals during the meetings. Although Chinese company law clearly stipulates the responsibility of directors to formulate plans, these plans cannot be collectively formed and proposed by the directors.

⁴Network information, URL: <https://wenku.baidu.com/view/cc98acd805a1b0717fd5360cba1aa81144318fca.html>

Table 13. Robust test: effects of important positions.

	<i>Envirp</i>							
	Politically connected chairman		Non-politically connected chairman		Politically connected CEO		Non-politically connected CEO	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Mpc_rat</i>	-0.0542*** (-5.23)		-0.0151* (-1.67)					
<i>Mpc_level</i>		-0.4998*** (-4.82)		-0.2115** (-2.48)				
<i>Bpc_rat</i>					0.0039 (0.22)		-0.0063 (-1.56)	
<i>Bpc_level</i>						0.0656 (0.23)		-0.0818 (-1.33)
<i>Size</i>	0.9755*** (8.15)	0.9907*** (8.01)	0.7966*** (14.47)	0.8117*** (14.63)	1.1153*** (4.99)	1.1315*** (5.17)	0.7883*** (15.20)	0.7807*** (15.20)
<i>Lev</i>	-0.0083 (-1.08)	-0.0047 (-0.62)	0.0102** (2.40)	0.0100** (2.36)	-0.0339* (-1.85)	-0.0355* (-1.88)	0.0095** (2.50)	0.0095** (2.50)
<i>Roe</i>	-0.017 (-1.28)	-0.0192 (-1.45)	-0.0076 (-1.01)	-0.0075 (-1.01)	-0.0591** (-2.37)	-0.0585** (-2.37)	-0.0058 (-0.86)	-0.006 (-0.89)
<i>Growth</i>	-0.0004 (-0.07)	0 (0.01)	0.0012 (0.41)	0.0014 (0.50)	0.0033 (0.36)	0.0028 (0.31)	0 (-0.01)	-0.0001 (-0.03)
<i>Fcf</i>	-0.0107 (-0.57)	-0.0121 (-0.63)	0.0502*** (4.62)	0.0513*** (4.72)	-0.0371 (-0.83)	-0.036 (-0.81)	0.0410*** (4.25)	0.0409*** (4.24)
<i>Top1</i>	-0.0025 (-0.28)	0.0035 (0.41)	-0.0005 (-0.13)	-0.0004 (-0.11)	0.026 (1.39)	0.0239 (1.33)	-0.0005 (-0.14)	-0.0008 (-0.21)
<i>Outrat</i>	-0.0162 (-0.71)	-0.0075 (-0.33)	0.0073 (0.62)	0.0078 (0.66)	-0.0233 (-0.47)	-0.0237 (-0.48)	0.0063 (0.59)	0.0052 (0.49)
<i>Boardsize</i>	-0.1407*** (-2.62)	-0.086 (-1.63)	0.008 (0.22)	0.006 (0.17)	-0.0816 (-0.96)	-0.0904 (-1.17)	-0.0113 (-0.35)	-0.005 (-0.15)
<i>Soe</i>	0.1111 (0.43)	0.091 (0.35)	0.1719 (1.29)	0.1645 (1.24)	0.6036 (1.18)	0.5659 (1.03)	0.1357 (1.12)	0.1261 (1.04)
<i>_Cons</i>	-2.8634* (-1.69)	-4.8016*** (-2.79)	-1.8124 (-1.31)	-1.9819 (-1.44)	-7.3046** (-2.07)	-6.6664* (-1.94)	-2.1720* (-1.67)	-2.0626 (-1.59)
<i>Ind/Year</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	215	215	695	695	69	69	841	841
<i>adj. R-sq</i>	0.437	0.426	0.42	0.423	0.625	0.625	0.383	0.383

t statistics in parentheses.

* p < 0.1, ** p < 0.05, ***p < 0.01.

They need to be drafted by the subordinate departments directly managed by senior executives before the board meeting is held, and according to the degree of the importance of the proposal, it is judged that the proposal should be decided by a committee of the board or be reported to the board for their decisions. For example, Nantong Minnuo Machinery Co., Ltd. established a strategy committee, an audit committee, an investment committee, and an operation committee under the board and stipulated the responsibilities of each committee in the company's articles of association. Consider the investment committee as an example. One of its duties is to review annual investment plans and investment product structures and submit them to the board for approval. After approval, the investment committee is responsible for specific operations and checks, and the annual investment plan can be adjusted every six months.⁴ In addition, the audit committee is also responsible for supervising corporate governance, executives, and directors. It can be seen that establishing and operating board committees can make up for the shortcomings of the board as a conference body organ, help the board exert supervision and a certain degree of decision-making during the inter-session period, and restrict senior executives to a certain extent.

Table 14. Additional tests: the balancing effect of committees under the board.

	(1)	(2)	(3)	(4)
	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>
<i>Mpc_rat</i>	-0.1679*** (-3.84)	-0.1634*** (-3.83)		
<i>Mpc_rat</i> × <i>Wyh</i>	0.0360*** (3.11)	0.0363*** (3.21)		
<i>Mpc_level</i>			-2.3830*** (-5.89)	-2.3739*** (-6.15)
<i>Mpc_level</i> × <i>Wyh</i>			0.5213*** (5.13)	0.5222*** (5.39)
<i>Wyh</i>	-0.0736 (-0.62)	-0.0032 (-0.03)	-0.1616 (-1.37)	-0.1048 (-0.91)
<i>Zlrat</i>	0.0511 (0.13)	0.4366 (1.13)	0.1024 (0.27)	0.4685 (1.23)
<i>Tmrat</i>	0.1301 (0.25)	0.012 (0.02)	0.1791 (0.34)	0.0799 (0.16)
<i>Sjrat</i>	-0.313 (-0.61)	0.1513 (0.30)	-0.3566 (-0.70)	0.0948 (0.19)
<i>Xcrat</i>	0.3806 (0.71)	0.4345 (0.83)	0.2634 (0.49)	0.3134 (0.61)
<i>Size</i>	0.6140*** (13.19)	0.7390*** (14.97)	0.6162*** (13.26)	0.7512*** (15.27)
<i>Lev</i>	0.0055 (1.51)	0.0094** (2.55)	0.0063* (1.76)	0.0101*** (2.79)
<i>Roe</i>	-0.0062 (-1.06)	-0.0081 (-1.43)	-0.0052 (-0.91)	-0.0071 (-1.26)
<i>Growth</i>	0.0024 (1.29)	0.0008 (0.41)	0.0029 (1.52)	0.0013 (0.68)
<i>Fcf</i>	0.0435*** (4.70)	0.0325*** (3.62)	0.0444*** (4.85)	0.0332*** (3.75)
<i>Top1</i>	0.0002 (0.04)	0.0045 (1.24)	0 (0.01)	0.0041 (1.15)
<i>Outrat</i>	-0.0059 (-0.58)	0.0055 (0.54)	-0.0029 (-0.29)	0.0099 (0.99)
<i>Boardsize</i>	-0.0254 (-0.83)	-0.0419 (-1.41)	-0.0107 (-0.35)	-0.0312 (-1.07)
<i>Soe</i>	0.2204* (1.78)	0.2258* (1.87)	0.2319* (1.89)	0.2217* (1.86)
<i>_Cons</i>	-0.357 (-0.46)	-2.537 (-1.42)	-0.3248 (-0.41)	-2.5939 (-1.47)
<i>Ind/Year</i>	No	Yes	No	Yes
<i>N</i>	910	910	910	910
<i>adj. R-sq</i>	0.313	0.391	0.325	0.408

t statistics in parentheses.

* p < 0.1, ** p < 0.05, *** p < 0.01.

Previous analyses show that the PCs of senior executives inhibit the company's EPI, and the establishment of various committees under the board of directors consolidates the rights of the directors and provides protection for the effective performance of its functions. Therefore, we expect that the establishment of committees under the board can alleviate the negative effect of politically connected executives on EPI. To test this expectation, we construct Equation (8).

$$\begin{aligned}
 \text{Envirp}_{i,t} = & \alpha + \beta_0 \text{Mpc}_{i,t} + \beta_1 \text{Mpc}_{i,t} \times \text{Wyh}_{i,t} + \beta_2 \text{Zlrat}_{i,t} + \beta_3 \text{Tmrat}_{i,t} + \beta_4 \text{Sjrat}_{i,t} \\
 & + \beta_5 \text{Xcrat}_{i,t} + \beta_6 \sum \text{Controls}_{i,t} + \varepsilon_{i,t}
 \end{aligned} \quad (8)$$

where $Wyh_{i,t}$ represents the number of committees under the board in a company. If there is a balancing effect, the coefficient of $Mpc \times Wyh$ is expected to be positive. $Zlrat$, $Tmrat$, $Sjrat$, and $Xcrat$, respectively, represent the proportion of grey directors of the committee in the strategy committee, nomination committee, audit committee, and remuneration committee. If the committee is not established and the number of grey directors in the committee is zero, the ratio is zero. Other control variables remain the same. The above data are obtained from the CSMAR database. The reason for controlling for the proportion of these four committees is that most companies set up the four committees (Xie, 2005). The regression results are shown in Table 14. The coefficients of $Mpc_rat \times Wyh$ and $Mpc_level \times Wyh$ are significantly positive at the 1% level, indicating that establishing board committees can alleviate the inhibitory effect of politically connected executives on environmental protection related investment, that is, board committees can play a balancing role. The establishment of the committees under the board weakens the externality of environmental pollution by internal governance and provide new ideas for corporate environmental protection governance.

5.2. EPI and the corporate value

Resource-dependence theory and previous literature show that politically connected firms can acquire more social resources (Claessens et al., 2008; Lian et al., 2011; Pan et al., 2008), but they are not active at performing environmental protection responsibilities. We assume that the reaction of capital market to the corporate EPI is passive, and this would lead to a decrease in corporate value. We verified this assumption in two ways:

First, we use Equation (9) for testing.

$$Value_{i,t} = \alpha + \beta_0 Envirp_{i,t} + \beta_1 \sum Controls_{i,t} + \varepsilon_{i,t} \quad (9)$$

where $Value_{i,t}$ is the value of the company, measured by both Tobin's Q and the market-to-book ratio (MB). The data are collected from CSMAR, and the control variables are the same as former.

Second, we use nearest neighbour PSM to revise the potential sample self-selection problem in the first method. We still use Equation (6) to perform the PSM, and then, we use the matched samples to estimate Equation (9).

The results are shown in Tables 15 and 16, respectively. The coefficients of $Envirp$ are all significantly negative at the 1% level. The greater the EPI, the lower is the corporate value, suggesting that the market reacts negatively for EPI, which is consistent with Shen et al. (2012). As the market reacts negatively to EPI, politically connected companies tend to obtain generally recognised and short-run benefits, and they use their rent-seeking ability to invest as little as possible in EPI, which also explains the negative relationship between PCs and environmental protection investment.

5.3 Do the Chinese central government's environmental protection regulations work? A DID analysis based on the 18th CPC National Congress

The report on the 18th CPC National Congress stated that 'the construction of ecological civilisation must be focused at a prominent position. Ecological civilisation should be

integrated into all aspects of our blue print, including economic, politics, cultural and society, and strive to build a more beautiful China and realise the sustainable development' Therefore, we intend to test whether the call of the 18th CPC National Congress to 'beautiful China' promotes the corporations to fulfill our environmental protection responsibilities, and whether it can alleviate the negative effect of corporate PCs on EPI. To verify this idea, we use the difference-in-difference method. First, we use PSM to obtain matched samples. Specifically, we first use the probit model to estimate Equation (10) and obtain the propensity scores, and then match the samples according to the scores. The definitions of the variables Equation (10) are the same as above, and the industry and year effects are controlled. After PSM, the samples show no significant differences in their other characteristics, except whether they have political ties.

$$Pc_dummy_{i,t} = \alpha + \beta_0 Size_{i,t} + \beta_1 Lev_{i,t} + \beta_2 Roe_{i,t} + \beta_3 Growth_{i,t} + \beta_4 Fcf_{i,t} + \beta_5 Top_{i,t} + \beta_6 Outrat_{i,t} + \beta_7 Boardsize_{i,t} + \beta_8 Soe_{i,t} + V_{i,t} \quad (10)$$

$$Envirp_{i,t} = \alpha + \beta_0 Treat_{i,t} + \beta_1 Post_{i,t} + \beta_2 Treat_{i,t} \times Post_{i,t} + \beta_3 \sum Controls_{i,t} + \varepsilon_{i,t} \quad (11)$$

Second, we estimate Equations (11) Equation (11) to verify the above assumption, where $Post_{i,t}$ is a time variable. Since the 18th CPC National Congress was held on 8 November 2012, then we define $Post$ equals to '0' = = when year t is are between 2010 and 2012; when year t is between 2013 and 2017, $Post$ equals '1.' $Treat$ is a grouping variable. If the company has political connections in year t , $Treat$ equals '1,' otherwise, it equals '0'; the control variables are the same as former. The results are shown in columns (7) and (8) of Table 15. The coefficients of $Treat \times Post$ are both significantly positive, while the coefficients of $Treat$ are both significantly negative, indicating that politically related companies tend to invest less in the environmental protection, but after the 18th CPC National Congress, the negative effect of PCs on EPI is mitigated.

5.3. PCs, institutional circumstances, and EPI

The motivation for corporate EPI mainly comes from the supervision and restriction of the external institutional circumstances. As a major entity within external institutional framework, the government's environmental regulations can enhance industrial green competitiveness (Du et al., 2019) and ensure that corporations fulfill their environmental protection responsibilities. The regulations set by the government are mainly divided into three categories: administrative regulations, economic regulations, and market regulations. The Chinese government mainly uses administrative and economic regulations. From economic aspect, Chinese authorities require corporate sewage charges, which would reduce pollution yet simultaneously hamper economic development (Fan, 2018). The standards of pollution discharge fees are determined by local governments based on specific local conditions, and it is difficult to distinguish the strength of local supervision through charging standards. Therefore, we use government administrative regulations to investigate the impact of government regulations in the external institutional environment on EPI. Local governments issue local regulations to encourage environmental protection behaviour, pollution control, and other issues, and they impose environmental pollution penalties on companies that violate relevant laws and regulations. We define

Table 15. Additional tests: EPI and corporate value: A DID analysis.

	EPI and firm value				DID analysis based on the shock of 18 th national congress of CPC			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Envirp</i>	-0.0789*** (-4.32)	-0.0793*** (-4.33)	-0.0789*** (-4.32)	-0.1002*** (-4.77)	-0.0793*** (-4.33)	-0.1029*** (-4.87)	<i>Envirp</i>	<i>Envirp</i>
<i>Treat</i>							-0.6901* (-1.84)	-0.7297** (-2.02)
<i>Post</i>							-0.2239 (-0.83)	-0.4644 (-1.22)
<i>Treat*Post</i>							0.8526** (2.19)	0.6078* (1.70)
<i>Size</i>	-0.3755*** (-12.67)	-0.3765*** (-12.66)	-0.3755*** (-12.67)	-0.4003*** (-11.75)	-0.3765*** (-12.66)	-0.3995*** (-11.65)	0.5620*** (7.88)	0.7260*** (9.83)
<i>Lev</i>	-0.0214*** (-10.72)	-0.0113*** (-5.62)	-0.0214*** (-10.72)	-0.0229*** (-9.98)	-0.0113*** (-5.62)	-0.0123*** (-5.33)	0.0117* (1.95)	0.0160*** (2.78)
<i>Roe</i>	0.0151*** (4.83)	0.0157*** (4.98)	0.0151*** (4.83)	0.0157*** (4.36)	0.0157*** (4.98)	0.0161*** (4.45)	-0.0136* (-1.85)	-0.0156** (-2.21)
<i>Growth</i>	0.001 (0.97)	0.001 (0.93)	0.001 (0.97)	0.0018 (1.57)	0.001 (0.93)	0.0020* (1.73)	-0.0002 (-0.08)	-0.0013 (-0.55)
<i>Fcf</i>	0.0096* (1.92)	0.0093* (1.86)	0.0096* (1.92)	0.0118** (2.06)	0.0093* (1.86)	0.0112* (1.95)	0.0221* (1.68)	0.0068 (0.55)
<i>Top1</i>	0.0060*** (3.09)	0.0061*** (3.12)	0.0060*** (3.09)	0.0063*** (2.81)	0.0061*** (3.12)	0.0063*** (2.80)	0.0106* (1.80)	0.0136** (2.39)
<i>Outrat</i>	0.0215*** (3.89)	0.0213*** (3.84)	0.0215*** (3.89)	0.0235*** (3.70)	0.0213*** (3.84)	0.0232*** (3.62)	-0.0270* (-1.69)	0.0038 (0.24)
<i>Boardsize</i>	0.0185 (1.14)	0.0187 (1.15)	0.0185 (1.14)	0.0226 (1.21)	0.0187 (1.15)	0.025 (1.33)	0.025 (1.36)	-0.0325 (-0.80)
<i>Soe</i>	-0.2294*** (-3.51)	-0.2329*** (-3.55)	-0.2294*** (-3.51)	-0.2467*** (-3.28)	-0.2329*** (-3.55)	-0.2469*** (-3.26)	0.18 (0.93)	0.112 (0.61)
<i>_Cons</i>	7.5346*** (7.91)	7.5612*** (7.91)	7.5346*** (7.91)	7.9127*** (7.22)	7.5612*** (7.91)	7.8578*** (7.12)	0.383 (0.41)	-0.6803 (-0.47)
<i>Ind/Year</i>	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
<i>N</i>	910	910	910	910	910	910	386	386
<i>adj. R-sq</i>	0.563	0.486	0.563	0.552	0.486	0.482	0.301	0.439

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

Table 16. Additional tests: EPI and corporate value (PSM matching sample test).

	EPI and corporate value: PSM matching sample tests					
	(1)	(2)	(3)	(4)	(5)	(6)
	<i>MB1</i>	<i>MB2</i>	<i>Tobin'Q1</i>	<i>Tobin'Q2</i>	<i>Tobin'Q3</i>	<i>Tobin'Q4</i>
<i>Envirp</i>	-0.0431*** (-2.76)	-0.0426*** (-2.73)	-0.0431*** (-2.76)	-0.0555*** (-3.25)	-0.0426*** (-2.73)	-0.0560*** (-3.27)
<i>Size</i>	-0.4667*** (-12.79)	-0.4675*** (-12.82)	-0.4667*** (-12.79)	-0.4868*** (-12.21)	-0.4675*** (-12.82)	-0.4859*** (-12.15)
<i>Lev</i>	-0.0206*** (-8.84)	-0.0105*** (-4.49)	-0.0206*** (-8.84)	-0.0232*** (-9.12)	-0.0105*** (-4.49)	-0.0127*** (-4.98)
<i>Roe</i>	0.0166*** (4.76)	0.0169*** (4.83)	0.0166*** (4.76)	0.0164*** (4.31)	0.0169*** (4.83)	0.0166*** (4.34)
<i>Growth</i>	0.0003 (0.28)	0.0003 (0.27)	0.0003 (0.28)	0.0009 (0.80)	0.0003 (0.27)	0.001 (0.91)
<i>Fcf</i>	0.0102* (1.75)	0.0099* (1.70)	0.0102* (1.75)	0.0116* (1.83)	0.0099* (1.70)	0.0110* (1.74)
<i>Top1</i>	0.0048** (2.03)	0.0050** (2.08)	0.0048** (2.03)	0.0042 (1.61)	0.0050** (2.08)	0.0041 (1.59)
<i>Outrat</i>	0.0190*** (2.72)	0.0190*** (2.71)	0.0190*** (2.72)	0.0196** (2.56)	0.0190*** (2.71)	0.0196** (2.55)
<i>Boardsize</i>	0.0181 (0.91)	0.0182 (0.91)	0.0181 (0.91)	0.018 (0.82)	0.0182 (0.91)	0.0202 (0.92)
<i>Soe</i>	-0.2117*** (-2.67)	-0.2130*** (-2.68)	-0.2117*** (-2.67)	-0.2221** (-2.56)	-0.2130*** (-2.68)	-0.2174** (-2.50)
<i>_Cons</i>	7.7914*** (12.09)	7.7918*** (12.10)	7.7914*** (12.09)	8.3770*** (11.90)	7.7918*** (12.10)	8.3568*** (11.84)
<i>Ind/Year</i>	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	858	858	858	858	858	858
<i>adj. R-sq</i>	0.496	0.422	0.496	0.492	0.422	0.418

t statistics in parentheses.

* p < 0.1, ** p < 0.05, ***p < 0.01.

the government's promulgation of local regulations and local rules as environmental legal supervision (*Legal*), and the environmental administrative penalties imposed by the government on companies that violate the regulations as environmental pollution supervision (*Punish*). *Legal* adopts the number of local regulations issued in the environmental legal work of each region in the 'China Environment Yearbook' (Li & Weng, 2014). It is accumulated year-by-year since 2009. If the value of the province where the company is located is greater than the average value of the year, *Legal* equals '1,' which means the supervision is stronger; otherwise, *Legal* equals '0,' which means the supervision is weaker. *Punish* takes the number of administrative punishment cases in each region in the current year divided by the total number of local manufacturing corporations. If the value of the province where the company is located is greater than the average value of the year, *Punish* equals '1,' which means the supervision is stronger; otherwise, *Punish* equals '0,' which means the supervision is weaker. Previous studies usually adopt the

Table 17. Descriptive statistics of corporate EPI under different government regulations circumstances.

		N	mean	p50	sd	p25	p95	Mean difference
<i>Envirp</i>	Weak pollution supervision	582	8.121	8.209	1.872	6.82	11.18	0.308**
	Strong pollution supervision	328	7.813	7.866	2.142	6.349	11.33	
	Weak legal supervision	527	8.203	8.294	2.003	6.909	11.64	0.459***
	Strong legal supervision	383	7.744	7.822	1.913	6.361	10.78	

t statistics in parentheses.

* p < 0.1, ** p < 0.05, ***p < 0.01.

number of environmental administrative punishment cases in each region as the measurement (Wang et al., 2017; Wang & Xu, 2015). But we argue that the economic structure varies across different provinces in China, so are the number of manufacturing firms. The number of environmental administrative penalty cases does not directly reflect the intensity of environmental pollution supervision. Therefore, we use the total number of local manufacturing firms for revision. Moreover, the number of environmental administrative penalty cases in each region in the past several years in the China Environmental Yearbook has not been published, so it is more intuitive and accurate to measure the intensity of environmental supervision by dividing the number of administrative punishment cases in each region by the total number of local manufacturing firms. We group the samples according to the intensity of government regulations and display the descriptive statistics in Table 17. It can be seen that the mean values of *Envirp* in areas with weak/strong environmental pollution supervision are 8.121 and 7.813, respectively, and the mean values of *Envirp* in areas with weak/strong environmental legal supervision are 8.203 and 7.744, respectively, indicating that the EPI in areas with weak government regulation is greater than in areas with strong government regulation, suggesting that the 'pollution paradise hypothesis' in China exists Chinese territory is vast, and the intensity of government environmental regulations varies with the region. Intensive government

Table 18. Additional tests: PCs, institutional circumstances and EPI.

	Weak pollution monitoring		Strong pollution monitoring		Weak legal monitoring		Strong legal monitoring	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>	<i>Envirp</i>
<i>Mpc_rat</i>	-0.0241*** (-3.07)		-0.0138 (-1.28)		-0.0242*** (-2.88)		-0.0352*** (-3.73)	
<i>pc_firm</i>		-0.3268*** (-4.49)		-0.051 (-0.44)		-0.3142*** (-4.01)		-0.3011*** (-2.78)
<i>Size</i>	0.9102*** (14.64)	0.9310*** (15.07)	0.8003*** (9.50)	0.7943*** (9.12)	0.7129*** (11.10)	0.7415*** (11.48)	0.8795*** (11.16)	0.8925*** (11.07)
<i>Lev</i>	0.0052 (1.26)	0.0051 (1.24)	-0.0029 (-0.37)	-0.0026 (-0.33)	0.0082 (1.63)	0.0076 (1.52)	0.0082 (1.52)	0.0089 (1.63)
<i>Roe</i>	-0.0044 (-0.74)	-0.0039 (-0.66)	-0.0207 (-1.48)	-0.021 (-1.49)	-0.0041 (-0.54)	-0.0036 (-0.49)	-0.0086 (-0.95)	-0.0097 (-1.07)
<i>Growth</i>	0.0004 (0.18)	0.001 (0.51)	0.0023 (0.54)	0.0024 (0.56)	0.0014 (0.58)	0.0019 (0.78)	0.0001 (0.02)	0.0003 (0.09)
<i>Fcf</i>	0.0444*** (4.53)	0.0446*** (4.59)	0.0038 (0.21)	0.0036 (0.19)	0.0239* (1.93)	0.0242** (1.97)	0.0483*** (3.62)	0.0505*** (3.76)
<i>Top1</i>	0.0080* (1.95)	0.0078* (1.92)	0.003 (0.43)	0.0037 (0.54)	0.0008 (0.16)	0.0009 (0.17)	0.0071 (1.33)	0.0087 (1.63)
<i>Outrat</i>	-0.0055 (-0.49)	-0.0019 (-0.17)	0.0014 (0.07)	-0.0012 (-0.06)	0 (-0.00)	0.0018 (0.14)	-0.0115 (-0.60)	-0.0111 (-0.58)
<i>Boardsize</i>	-0.0696* (-1.90)	-0.0673* (-1.86)	0.0227 (0.44)	0.028 (0.54)	-0.0906** (-2.44)	-0.0819** (-2.22)	0.0409 (0.76)	0.0464 (0.85)
<i>Soe</i>	0.3049** (2.23)	0.3088** (2.29)	-0.2241 (-0.97)	-0.2307 (-0.99)	0.11 (0.67)	0.1072 (0.66)	0.1321 (0.74)	0.1369 (0.76)
<i>_cons</i>	-2.6537** (-2.02)	-3.0576** (-2.34)	-5.0065*** (-2.73)	-5.0225*** (-2.71)	0.0978 (0.05)	-0.4661 (-0.25)	-4.1055** (-2.09)	-4.5374** (-2.28)
<i>Ind/Year</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>N</i>	582	582	328	328	527	527	383	383
<i>adj. R-sq</i>	0.432	0.442	0.397	0.394	0.352	0.362	0.432	0.422

t statistics in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

regulations increase the operating costs of the firms. According to the principle of cost compliance, the company would choose to invest and build factories in areas with weaker external regulations to maximise benefits. Since the EPI of the polluting industries is generally higher than that of non-polluting industries, the average EPI in areas with weaker government environmental regulations is greater. Therefore, we put the intensity of government environmental regulation as a grouping variable in Equation (1) and explore the impact of PCs on EPI under different environmental regulation intensities. Table 18 reports the impact of PCs on EPI in different environments where government legal supervision and pollution supervision are strong and weak. As shown in columns (1)–(4), in areas with weak pollution supervision, the coefficients of *Mpc_rat* and *Mpc_level* are both significantly negative at the 1% level, whereas in areas with strong pollution supervision, the coefficients of *Mpc_rat* and *Mpc_level* are no longer significant. In columns (5)–(8), whether in areas with weak or strong legal supervision, the coefficients of *Mpc_rat* and *Mpc_level* are both significantly negative, indicating that government regulation can alleviate the negative effect of PCs on EPI. Compared with government legal supervision, government pollution supervision is more effective, perhaps because politically connected firms are more sensitive to environmental administrative penalties and use these penalties as the vanes of local environmental regulations to make economic decisions on EPI. The effect of government legal supervision is weaker, which also confirms that PCs affect the efficiency of law enforcement from a multi-dimensional aspects (Xu Qian et al., 2013), thereby reducing the effectiveness of legal environment supervision.

6. Conclusions

The 19th CPC National Congress proposes to insist on saving resources and protecting the environment as a basic national policy. As important members of the environmental protection framework, corporations play a vital role in achieving green production, saving resources, and reducing energy consumption. Based on China's specific institutional context, we manually collected data on the EPI of China's A-share listed companies from 2010 to 2017, investigating the impact of PCs on corporate EPI. We find that first, PCs negatively affect firms' EPI; specifically, the more politically connected executives are hired, and the higher the rank of the politically connected executives, the lower is the EPI by the firms. Second, compared to politically connected directors, politically connected executives more significantly influence corporate EPI. Additional analyses reveal that the establishment of various types of board committees can alleviate the negative effects of PCs on EPI. However, the feedback on the capital market on corporate EPI is passive, which means that corporate value decreases after the disclosure of EPI. Finally, the call for 'constructing a more beautiful China,' raised at the 18th and 19th CPC National Congress, and the mandatory environmental protection regulations set down by China's central government can alleviate the negative impact of PCs on EPI, and environmental pollution monitoring has a more significant mitigating effect than legal monitoring.

Our findings also offer some practical insights. On the one hand, because the existing regulations are not strictly implemented, firms, especially those with PCs, do not have the motivation for EPI. Therefore, environmental protection ratings can be

conducted regularly based on the company's production processes (whether or not energy-saving and environmentally friendly), pollution emissions, and governance conditions. The lowest-rated firms should not be allowed to apply for government subsidies. The ultimate controllers should not be allowed to register new firms. Such fierce action may encourage firms to invest in environmental protection. On the other hand, although environmental performance indicators have been added to the evaluation of local officials' promotion, the opacity and manipulability of the environmental protection data undermine the goal. To improve the transparency of the local environmental protection data and to enhance the supervision of their disclosure, manipulation must be severely punished. Ensuring efficient implementation of the regulations should be the direction of China's reforms of the government's function.

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