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Original Research

Does Political Turnover Affect Enterprise Environmental Protection Investment? Evidence from China

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Abstract

It is of great significance to study the impact and mechanism of political turnover on enterprise environmental protection investment (EEPI) under the government environmental performance appraisal system. In this paper, we investigate how political turnover affects enterprise environmental protection investment based on the data of Chinese share listed companies from 2009 to 2018. The results show that political turnover has a significantly positive effect on EEPI. Moreover, we provide evidence that collusion deterrence and official promotion incentive are the mechanisms through which turnover of local officials promotes enterprises to increase investment in environmental protection. Additional moderating tests show that the degree of market competition strengthens the positive impact of political turnover on EEPI, while provincial environmental competitiveness inhibits this relationship. This paper analyzes the enterprise environmental governance mechanism from the perspective of political economy, which has enlightenment significance for the improvement of the Chinese government's environmental supervision system and the construction of ecological civilization.

Keywords: political turnover, enterprise environmental protection investment, collusion deterrence, official promotion incentive, external environmental

Introduction

Harmonious economic development and environmental protection have always been regarded as a vital goal in global politics and economy. Since the implementation of the 'reform and opening up' policy, China's economy has achieved remarkable economic growth and has become the second largest economy in the world [1], and local governments have played an important role in this growth process [2]. Compared with other emerging market countries, China is ruled by one political party and is not 'checked and

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balanced' by other political institutions, which makes the government and its officials have a much greater impact on enterprises than other emerging market countries [3, 4]. Thus, many researchers recognize that Chinese local officials who have key control over local economic activities play a core role in local economic development [5], because local officials have great power in local economic policy-making and resource allocation [6]. However, local officials are keen to build local infrastructure and support the development of local enterprises, resulting in the increasing problem of excessive use of resources and pollution in their jurisdiction. One main view is that economic growth is one of the main performance evaluation indicators of local officials in China. The political promotion competition encourages local officials to turn their 'helping hand' into a 'grabbing hand', which leads to an abnormal economic development model. Therefore, environmental problems in China are the result of economic development [7], and the driving force of economic development comes from local officials [8].

According to the 2022 Global Environmental Performance Index jointly released by Yale Center for Environmental Law & Policy, Yale University, and Center for International Earth Science Information Network, Columbia University, China ranks 160th in environmental performance, indicating that environmental issues cannot be ignored in China. According to data from the United Nations Environment Programme (UNEP), approximately 80% of global environmental pollution is caused by human activities, especially by the production and operation of enterprises [9]. Therefore, the Chinese government has paid unprecedented attention to the construction of ecological civilization in recent years. The 18th National Congress of the Communist Party of China incorporated ecological civilization into the overall strategy of building socialism with Chinese characteristics [1], and the construction of ecological civilization became an important performance evaluation index for local officials [10]. Especially, as a micro unit of economy and society, enterprises should take the initiative to bear the responsibility of environmental protection and promote the sustainable development of economy and ecology. In various investment decisions, investment in environmental protection is not only an important way for enterprises to bear the responsibility of environmental protection [11], but also plays an important role in the sustainable development of enterprises. Existing literature has confirmed some factors affecting EEPI, such as enterprise size [12], financial status [13], industry environment [14], environmental regulations [15] and fiscal decentralization [16, 17]. It can be seen that the existing literature mostly analyzes the impact on EEPI from the two aspects of internal factors and external macro environment. The influence of local officials on EEPI has been mostly ignored. Although the local officials play a vital role in the market and have a great impact on the environmental protection behavior of enterprises in China's institutional environment, the impact of government power change on EEPI is much less studied compared with the political impact on enterprise investment. In particular, the impact of the turnover of local officials on EEPI has not been explored to a great extent.

The departure and succession of officials is known as political turnover, which refers to the internal reconfiguration of power holders within the government. The political turnover in China originates from the cadre exchange system [18]. In China, local governments have the power to govern the economy and flexibly implement economic policies. Therefore, political turnover, especially the personnel turnover of senior leadership positions, has been found to be a key factor affecting China's economy [19]. The economic consequences of political turnover have attracted extensive attention of scholars. Previous studies have proved that political turnover has an impact on macroeconomic growth, mergers and acquisitions [20], stock market volatility [21], and micro enterprise investment [22, 23]. Thus, political turnover is not only an important factor to understand and study the behavior of local government, but also a new perspective to study the role of local officials in promoting regional economic growth and enterprise environmental protection behavior. However, the literature mainly focuses on the impact of political turnover on economic growth, without analyzing the role of government officials as decision-makers. This literature also rarely discusses official behavior related to tenure systems, political exchanges, etc. Given that the potential impact of government changes on the macro economy and micro enterprises, we have some questions, such as, does the successor officials improve the environmental quality to meet the environmental performance evaluation? How will the environmental protection investment of enterprises be affected during the period of political turnover? What are the mechanisms through which political turnover affects EEPI? The answers to these questions will be helpful in understanding the environmental protection investment of Chinese enterprises and will have enlightenment significance for deepening the reform of the government official management system.

The results of this paper are particularly closely related to China's recent policies, and the findings of this paper have the following several contributions: Firstly, the evidence we provide shows that political turnover affects the EEPI, which enriches the relevant research on the EEPI. Although existing studies show that environmental protection investment may be affected by government regulation [24, 25], there are few studies on how political change affects EEPI. A large amount of existing literature has confirmed that political leaders play an important role in determining government environmental protection priorities [26, 27, 28]. From the perspective of government enterprise relationship, we deeply investigate the impact of political turnover on EEPI, which enriches the research

on the influencing factors of enterprise environmental protection investment from the perspective of macro policy.

Secondly, we analyze the mechanism of influence of political turnover on EEPI, which helps us understand how political turnover affects EEPI. Although the previous literature confirms that political turnover affects enterprise activities, such as innovation [29] and investment [30], the mechanisms through which political turnover affects EEPI are still unclear. There are two main reasons why China has a suitable environment to study the relationship between political turnover and EEPI. On the one hand, China has frequent political turnover, which is different from other countries. The turnover of local officials can prevent them from establishing too many political relations with enterprises and being corrupted [31]. On the other hand, corporate environmental responsibility is regarded as an important business strategy by more and more local officials and investors [32]. Once local officials change, the political connection between former officials and enterprises is broken, and the decision-making of enterprises is adjusted accordingly. Therefore, we investigate whether political turnover may increase enterprises' attention to environmental protection and strengthen the channels for the implementation of environmental regulations, which promote the increase of enterprises' environmental protection investment. Therefore, our research provides an important supplement to the existing literature on political turnover and enterprise environmental protection behavior.

Finally, we examine the moderating effects of the external environment on regulating the impact of political turnover on EEPI. The degree of industry competition and provincial environmental competitiveness expands the research on the external environment. Most of the existing studies have investigated the impact of ownership structure [33, 34], but less about the impact of the external environment of enterprises. This paper enriches the research on how the external environment affects the relationship between political turnover and EEPI, and the results of this paper provide new empirical evidence for the impact of the external environment on enterprises. The findings of our research demonstrate that the Chinese government should continue to improve the external business environment of enterprises, build a good market environment and ecological environment atmosphere for enterprises to actively carry out environmental governance.

The follow-up structure of this paper is the following: Section 2 introduces theoretical background and hypotheses development; Section 3 describes research design, including data and sample, definition of variables and model design; Section 4 presents empirical results, including descriptive statistics, regression analysis results and robustness tests; Section 5 provides results of moderating effect; Section 6 concludes the paper.

Theoretical Background and Hypotheses Development

Political Turnover and EEPI

In China, the term of office of local officials is generally 5 years, with a maximum term of 10 years. However, the actual replacement time of these officials is on average about 3 years. Frequent changes in key officials make successor officials eager to perform, leading to significant uncertainty in the continuity and execution of policies. Therefore, the turnover of political relations caused by political replacement causes political uncertainty, which has an extremely important impact on the production and operation decision-making of micro enterprises [35]. Local governments in China control key resources, such as land and bank loans, which give them the right to formulate and implement local economic policies [29]. Although the policy is implemented by governments at all levels, the operation effectiveness largely depends on local officials. Under China's fiscal decentralization and the party's cadre assessment system, local officials promote economic growth within their jurisdiction by formulating and implementing different economic policies. Meanwhile, the hierarchical structure of China's administrative system makes the performance of each political leader distinguishable and comparable, thus establishing a reasonable link between political replacement and economic performance [36]. Therefore, local officials have great and flexible discretion in formulating macroeconomic policies and intervening in enterprise microeconomic activities [37].

Relevant literature indicates that the superior government evaluates whether local officials can be promoted according to their performance during their tenure in the political promotion competition, so local officials often try their best to impress the superior government [19]. Therefore, incorporating environmental indicators into the promotion and assessment system of local officials can correct the short-sighted behavior of local officials sacrificing the environment for economic growth, which can promote enterprises to increase environmental protection investment to improve regional environmental quality. The turnover of local officials means that the decision-makers of local governments have changed. Meanwhile, the superior government examines the performance of the successor officials by comparing the performance of the successor officials and the former officials, which urges the successor officials to actively implement the differentiated development strategy to make better achievements than the same level and former officials. The psychology of horizontal and vertical competition among officials promotes the local officials to chase the environmental performance of their jurisdiction to a certain extent. In addition, the main reason why the successor officials implemented strict environmental supervision policies at the beginning of taking office

is the long return cycle of environmental protection investment. Their purpose is to urge enterprises within their jurisdiction to invest in environmental protection and environmental governance, and finally achieve rapid improvement of local environmental performance during their tenure.

Government officials can bring considerable 'resource effects' to enterprises closely related to them. However, the turnover of officials leads to the rupture of the political relationship network between enterprises and outgoing officials, which leads to policy uncertainty [35]. Therefore, enterprises need to adjust their production and operation behavior in time. On the one hand, the turnover of officials leads to the redistribution of resources within the jurisdiction, because the successor officials reformulate government subsidies, tax incentives, land acquisition and other policies after taking office. In the face of this environmental change, enterprises meet the needs of government environmental policies by improving their environmental governance behavior, and then establish stable ties with new local officials to obtain certain resource allocation advantages [38]. Therefore, increasing environmental protection investment has become the best choice for enterprises. On the other hand, the gap period caused by the turnover of officials increases the investment risks faced by enterprises. Enterprises need to actively carry out environmental governance and consciously fulfill their social responsibilities, which can leave a good impression on succeeding officials to avoid and prevent operational risks. Especially under the background that China attaches great importance to the ecological environment, local officials investigate whether enterprises implement environmental protection policies by paying attention to the environmental governance and social responsibility reports of enterprises. However, political turnover is linked to policy uncertainty [39]. The policy uncertainty caused by official turnover increases the information asymmetry between enterprises and new officials. Therefore, enterprises need to expand the scale of environmental protection investment to convey good information to successor officials and the capital market.

As mentioned above, enterprises increase the scale of environmental protection investment during the transition period of local officials. In doing so, the enterprise not only shows the outside world its strong economic strength and good operating conditions, but also transmits the signal of actively implementing environmental governance policies and a strong sense of social responsibility, which helps to establish a good corporate image in front of successor officials and the public. Therefore, the first hypothesis of this paper is proposed:

Hypothesis 1: Political turnover is positively related to EEPI, that is, the turnover of local officials can promote enterprises to increase investment in environmental protection.

The Influence of Collusion Deterrence on the Relationship between Political Turnover and EEPI

Given the positive effect of political turnover on EEPI, we further explore the mechanism of the impact of official turnover on EEPI. The first mechanism by which the turnover of officials affects EEPI is collusive deterrence. The turnover of local officials breaks the 'relationship network' formed by outgoing officials during their term of office, which have a deterrent effect on polluting enterprises and urge them to increase environmental protection investment to solve pollution problems. Previous literature suggests that polluting enterprises are motivated to bribe local governments to reduce the degree of environmental supervision [40]. Due to GDP growth-oriented promotion assessment in China, the local government helps enterprises expand production scale by creating a 'green channel', which forms a conspiracy between enterprises and the government and aggravates local environmental pollution [41, 42]. Although the collusive relationship between polluting enterprises and local governments leads to the absence of the government's environmental supervision function, the 'political sensitive period' formed by the personnel turnover of local officials helps to break this collusive relationship and alleviate the problem of regional environmental pollution.

In addition, enterprises tend to establish a good corporate image by increasing environmental protection investment and actively performing social responsibility at the beginning of the successor officials taking office. This not only caters to the requirements of successor officials for environmental protection investment of enterprises within their jurisdiction, but also builds a good relationship between government and enterprises with successor officials, which helps enterprises obtain more resources from the government. Therefore, it can be considered that if the 'politically sensitive period' formed by the turnover of officials has a stronger deterrent effect on the original collusion between government and enterprises, it will have a greater impact on guiding enterprises in their jurisdiction to invest in environmental protection and improve environmental governance. Hence, the second hypothesis of this paper is proposed:

Hypothesis 2: The turnover of officials affects EEPI through collusion deterrence, that is, the collusion deterrence of political turnover on the original government enterprise collusion network plays a mediating role in the impact of political turnover on EEPI.

The Influence of Official Promotion Incentive on the Relationship between Political Turnover and EEPI

In order to solve the incentive distortion of environmental governance caused by the performance

appraisal system based on GDP growth, the '12th Five Year Plan for National Environmental Protection' takes environmental protection as an important indicator of local government performance appraisal system and implements a one-vote-veto system for local environmental protection [1]. It can be seen that these requirements closely link the appointment, evaluation and promotion of local officials at all levels with the environmental protection status of their jurisdiction. After environmental governance is incorporated into the assessment system, local officials with promotion objectives pay more attention to carry out environmental protection projects to promote their political publicity, which puts external pressure on enterprises to take the initiative to control pollution and carry out other environmental protection activities [43].

From the perspective of enterprises, they also face the assessment requirements of environmental governance. This has motivated enterprises to strengthen regional environmental governance in accordance with the central environmental protection policy to surpass the performance of their predecessors and obtain political promotion. Therefore, the official performance appraisal system with environmental governance indicators brings regulatory incentives to officials. As an important subject of supervision, local officials improve the supply of environmental public services and local ecology by exerting environmental supervision pressure on enterprises, and reduce ecological and environmental pollution. These measures can encourage enterprises to increase the scale of environmental protection investment and actively participate in environmental governance [44].

Therefore, in the process of personnel turnover of local officials, the successor officials with promotion objectives will continue the environmental protection policies of the former officials and even implement more stringent environmental protection supervision, which makes the environmental protection investment of enterprises increase and the pollution in the jurisdiction reduce. Thus, the third hypothesis in this paper is proposed as follows:

Hypothesis 3: The turnover of officials affects EEPI through official promotion incentive, that is, local officials' intervention in enterprise environmental governance under promotion incentive plays a mediating role in the impact of political turnover on EEPI.

Research Design

Data and Sample

We selected China's listed companies that disclosed environmental protection investment data from 2009 to 2018 as the initial sample. The first year is chosen as 2009 is that China's Ministry of ecological environment and Shanghai Stock Exchange officially established the enterprise environmental information disclosure system in 2008. Considering that Leading Cadres Tenure Interim Provisions of China stipulate a tenure length for local leaders of five years, we choose two five-year periods as the sample period to ensure the continuity and integrity of the data. To clean the data, the research samples are screened as follows: (1) companies with special treatment such as ST and PT are excluded. (2) financial, securities and insurance companies are dropped. (3) companies with abnormal financial data are eliminated. (4) companies with missing data are rejected.

The data of EEPI is obtained by collecting and sorting the environmental protection related expenses in the corporate social responsibility report and the notes to the financial statements. According to the cadre data published by China economic network and people's network, the change data of local officials are sorted out through Baidu search and backward launch of the native place, age, educational background, term of office and other data information of successive municipal Party secretaries. The financial data of the companies comes from China Securities Market and Accounting Research. Finally, we obtain the resume information of 439 municipal Party Secretaries in 167 cities where the enterprises were registered during the sample period, and obtain the sample data composed of 3450 observations of 694 companies. In addition, all of the continuous variables are winsorized at the level of 1% and 99% in order to reduce the influence of extreme values.

Definition of Variables

Dependent Variable: Enterprise Environmental Protection Investment

Following the literature [45, 46], we obtain the investment in environmental protection such as environmental protection technical transformation project investment, pollution control investment and environmental tax payment from the Annual Corporate Social Responsibility report. Then, we aggregate these data to get the total environmental protection investment of each enterprise. Finally, EEPI is measured by the ratio of total environmental protection investment to operating income.

Independent Variable: Political Turnover

In China's political system, the central government formulates national policies and appoints provincial government leaders. The provincial government formulates the provincial policies and appoints the leaders of the prefecture level government according to the national policies. Among provincial and prefecture level governments, Party Secretary has the highest level, followed by the governor or mayor and other administrative leaders [19]. The core of the relationship between the government and enterprises

is political power, which is in the hands of the Party Secretary. Thus, the Party Secretary is recognized as the highest level city officials in China, who have greater power in designing and implementing local policies [47]. Following the existing literature [36, 48], we mainly focus on the impact of the turnover of the Party Secretary on EEPI and use the turnover of Party Secretary to measure the political turnover. Considering that the successor officials need a period of adaptation and transition after taking office to establish a new government enterprise relationship, and referring to the existing research, we take July 1 as the dividing point. Specifically, if a Party Secretary in the place of enterprise registration takes office before July 1, then we record the current year as 1 and other years are recorded as 0. If a Party Secretary in the place of enterprise registration takes office after July 1, then we record the next year as 1 and other years are recorded as 0.

Mediating Variables

In order to test the deterrent effect of official turnover on the original government enterprise collusion relationship network and whether government intervention under promotion incentive is an important way for official turnover to affect EEPI, we use collusion deterrent and official promotion incentive as mediating variable to investigate the channels through which political turnover affects EEPI. Specifically, collusion deterrence is measured by the tenure of office of outgoing officials. The longer the tenure of office of outgoing officials, the easier it is to establish a stable collusion network between government and enterprises, which also means that the collusion deterrence of official replacement is stronger. Meanwhile, official promotion incentive is measured by the green GDP growth rate where the enterprise is located, unemployment rate and fiscal surplus of the city. Among them, green GDP (GGDP) = actual GDP - total industrial output value - 'three wastes' pollution emission loss, unemployment rate = number of urban registered unemployed persons/ (number of registered unemployed persons + number of employees), and fiscal surplus = (local fiscal revenue - fiscal expenditure local fiscal revenue.

Control Variables

Following the previous studies [11, 49, 50, 51], we control some firm-specific variables, such as firm size, financial leverage, profitability, free cash flow, growth, board size, proportion of independent directors, ownership concentration and equity balance. In addition, we also draw on existing research [52, 53] to control some variables related to the characteristics of officials, such as local officials' native place, age and education. Finally, industry fixed effects, year fixed effects and the city fixed effects are also controlled. All variables are defined in Table 1.

Model Design

To examine Hypothesis 1, the model to be tested as follows:

$$EEPI_{i,t} = \alpha + \alpha_1 Turnover_{i,t} + \alpha Controls_{i,t} + Industry_i + Year_t + City_j + \varepsilon_{i,t} \quad (1)$$

To investigate the mediating effect of collusion deterrent, we construct the following model:

$$Collusion_{i,t} = \alpha + \chi Turnover_{i,t} + \gamma Controls_{i,t} + Industry_i + Year_t + City_j + \varepsilon_{i,t} \quad (2)$$

$$EEPI_{i,t} = \alpha + \delta_1 Turnover_{i,t} + \delta_2 Collusion_{i,t} + \gamma Controls_{i,t} + Industry_i + Year_t + City_j + \varepsilon_{i,t} \quad (3)$$

To investigate the mediating effect of official promotion incentive, we construct the following model:

$$Promote_{i,t} = \alpha + \chi Turnover_{i,t} + \gamma Controls_{i,t} + Industry_i + Year_t + City_j + \varepsilon_{i,t} \quad (4)$$

$$EEPI_{i,t} = \alpha + \delta_1 Turnover_{i,t} + \delta_2 Promote_{i,t} + \gamma Controls_{i,t} + Industry_i + Year_t + City_j + \varepsilon_{i,t} \quad (5)$$

where i denotes an industry, t indicates a year, and j represents a city. ε_{it} is the random error term.

Empirical Results

Descriptive Statistics and Correlation Analysis

Table 2 presents the descriptive statistics of all variables. The mean and median of *EEPI* are 0.0046 and 0.0102, respectively, suggesting that the mean ratio of total environmental protection investment to operating income is 0.46%. However, the median is lower than the mean, indicating that there is a large gap between the *EEPI* of most sample companies and the average level, and also suggesting that the *EEPI* of Chinese companies is generally insufficient. The standard deviation of *Turnover* is 0.4428, indicating that there are significant differences in *Turnover*. The descriptive statistics of other variables are shown in Table 2.

Table 3 shows the Pearson correlation coefficient matrix to observe the correlation between the variables. It can be seen from Table 3 that the correlation coefficient between variables is relatively small and far lower than 0.5, suggesting that the correlation between the variables is not high. We also calculated the variance inflation factors (VIF) of the variables to ensure unbiased regression results. It is found that the VIF values of all variables are less than 3, which means that multicollinearity is not a serious problem in this paper. The results also show that *Turnover* is significantly and positively correlated with *EEPI*, which can verify Hypothesis 1.

Table 1. Definition of Variables.

Category	Name	Symbol	Definition
Dependent variable	Enterprise environmental protection investment	*EEPI*	Total environmental protection investment / operating income
Independent variable	Political turnover	*Turnover*	If a Party Secretary in the place of enterprise registration takes office before July 1, then we record the current year as 1 and other years are recorded as 0. If a Party Secretary in the place of enterprise registration takes office after July 1, then we record the next year as 1 and other years are recorded as 0.
Mediating variable	Collusion deterrent	*Collusion*	Dummy variable, it is equal to 1 if the tenure of office of the outgoing official is more than 3 years, and 0 otherwise.
	Official promotion incentive	*Promote*	Green GDP growth rate where the enterprise is located + unemployment rate + fiscal surplus of the city
Control variable	Firm size	*Size*	Ln (enterprise year-end total assets)
	Financial leverage	*Lev*	Total liabilities / total assets
	Profitability	*Roa*	Net earnings / total assets
	Free cash flow	*Cash*	Monetary fund balance / average total assets
	Growth	*Growth*	(current operating income - previous operating income) / previous operating income
	Board size	*Board*	Ln (number of directors at the end of the year)
	Proportion of independent directors	*Outdir*	Number of independent directors / total number of directors
	Ownership concentration	*Large*	Shareholding ratio of the largest shareholder
	Equity balance	*Balance*	Shareholding ratio of the second to fifth largest shareholders / shareholding ratio of the largest shareholder
	Native place of successor government officials	*Native*	Dummy variable, it is equal to 1 if the successor government official is native to place, and 0 otherwise.
	Age of successor government officials	*Age*	Dummy variable, it is equal to 1 if age of the successor government official is less than or equal to 55 years old, and 0 otherwise.
	Education of successor government officials	*Edu*	Dummy variable, it is equal to 1 if age of the successor government official is a graduate student or above, and 0 otherwise.
	Industry	*Industry*	Dummy variable
	Year	*Year*	Dummy variable
	City	City	Dummy variable

Table 2. Descriptive statistics.

Variable	N	Mean	SD	Min	Median	Max
EEPI	3450	0.0046	0.2084	0.0000	0.0028	0.1852
Turnover	3450	0.2658	0.4428	0.0000	0.0000	1.0000
Collusion	3450	0.5917	0.4916	0.0000	1.0000	1.0000
Promote	3450	1.2658	0.6924	0.0000	1.1800	3.0000
Size	3450	1.3651	0.1715	1.2833	1.3663	1.4549
Lev	3450	0.4955	0.1950	0.0721	0.4950	0.8530
Roa	3450	0.0452	0.1180	0.0026	0.1650	0.8100
Cash	3450	0.1649	0.0494	-0.1110	0.0452	0.2110
Growth	3450	0.1548	0.1940	0.0167	0.3050	0.7150
Board	3450	2.1750	0.1980	1.6094	2.1972	2.8904
Outdir	3450	0.3763	0.3520	0.3333	0.3333	0.8000
Large	3450	0.4230	0.1618	0.0654	0.4229	0.8855
Balance	3450	0.5175	0.5232	0.0045	0.3155	2.8486
Native	3450	0.0427	0.2045	0.0000	0.0000	1.0000
Age	3450	0.2033	0.3113	0.0000	0.0000	1.0000
Edu	3450	0.7868	0.4100	0.0000	1.0000	1.0000

Regression Analysis Results

Political Turnover on EEPI

The impact of political turnover on EEPI are shown in Table 4. Column (1) shows that the coefficient of *Turnover* is 0.0246 and significant at the 5% level, which suggests that a 1% increase of *Turnover* leads to the improvement of 0.0246 in *EEPI*. And also shows that there is a significant positive correlation between *Turnover* and *EEPI*. This result indicates that the turnover of local officials leads to the rupture of the local original government enterprise relationship network. Under the environment of political uncertainty, enterprises actively increase environmental protection investment to meet the needs of new officials' environmental performance to obtain the advantages of market resource allocation and avoid the operation and investment risks. Therefore, Hypothesis 1 is supported.

As for control variables, *Size, Growth, Native, Age*, and *Edu* has a significantly positive effect on *EEPI*, whereas *Lev, Roa, Cash, Large*, *Balance* has a significantly negative effect on *EEPI*. In addition, the coefficients of *Board* and *Outdir* are not significant at the significance level. The results of the control variables are consistent with the existing literature [4, 5, 54].

The Mediating Effect of Collusion Deterrence

We investigate the channels of political turnover affect the EEPI through collusive deterrence, and the results are shown in Columns (2) and (3), Table 4. The results given in Columns (2) show that the regression coefficient of *Turnover* is 0.0560 and significant at the 10% level when the dependent variable is *Collusion*. It is indicated that the collusion deterrence effect helps to promote the improvement of environmental protection awareness of local officials and the implementation of environmental regulation policies, so as to better urge enterprises within their jurisdiction to increase environmental protection investment. Furthermore, the results given in Column (3) show that the coefficient of *Turnover* and *Collusion* are significantly positive when the dependent variable is *EEPI*. Then, we calculate that the mediating effect of *Collusion* accounts for 54.54% of the total effect based on this result. These results show that the politically sensitive period formed by the turnover of local officials helps to break the government enterprise collusion relationship network between outgoing officials and enterprises and form a deterrent effect. The policy uncertainty and incoherence within the jurisdiction caused by this deterrent effect will strengthen the officials' motivation to govern the environment and promote enterprises' Environmental investment. Therefore, it is consistent with our prediction in Hypothesis 2.

The Mediating Effect of Official Promotion Incentive

We also investigate the channels of political turnover affect the EEPI through official promotion incentive, and the results are shown in Columns (4) and (5),

Table 3. Correlation matrix of variables.

Variable	*EEPI*	*Turnover*	*Size*	*Lev*	*Roa*	*Cash*	*Growth*	*Board*	*Outdir*	*Large*	*Balance*	*Native*	*Age*	*Edu*
EPI	1.0000													
Turnover	0.0380**	1.0000												
Size	0.1041***	-0.0328	1.0000											
Lev	-0.0924*	-0.0354	-0.0750**	1.0000										
Roa	-0.0391*	0.0030	-0.0375**	-0.0670	1.0000									
Cash	-0.0237*	-0.0013	0.0159*	0.0399	0.0432**	1.0000								
Growth	0.0372*	-0.0216*	0.0020***	-0.0458**	0.0150*	0.0147*	1.0000							
Board	0.0084	-0.0645*	0.0983***	-0.0130*	-0.0281***	-0.062***	-0.1207***	1.0000						
Outdir	0.0274	0.0030	-0.0431**	0.0280	-0.0627***	-0.1264***	0.0284***	0.3615*	1.0000					
Large	-0.0346**	0.0326*	0.0360***	-0.0314**	-0.0394***	-0.0130	0.3460***	-0.0253**	0.2491**	1.0000				
Balance	0.0339*	-0.0227*	-0.0293**	0.0228*	0.0833***	0.0625***	-0.0319***	-0.0717	-0.2840*	0.0018**	1.0000			
Native	0.0268**	0.0285*	0.0314	0.0157	-0.0022	0.0253*	0.0339	0.0589	0.1346	0.0028	0.0135	1.0000		
Age	0.0167**	0.0034*	0.0237	0.0036	-0.0043	0.0112	0.0126*	0.0338	0.0678*	0.0125	0.0691	0.2632**	1.0000	
Edu	0.0331*	0.0156*	0.0225	0.0112*	-0.0015	0.0128	0.0397**	0.0281	0.2463	0.0237	0.0238	0.1289	0.2932*	1.0000

Note: ***, ** and * indicate significance at the level of 1%, 5% and 10% respectively.

Table 4. The results in column (3) confirm that the regression coefficient of *Turnover* is significantly positive when the dependent variable is *Promote*, which suggests that the turnover of officials can improve their promotion incentive. Furthermore, the results given in Column (5) represent that the coefficient of *Turnover* and *Promote* are 0.5446 and 0.1376 respectively, and both significant at the 1% level when the dependent variable is *EEPI*. Then, we calculate that the mediating effect of *Promote* accounts for 76.88% of the total effect based on this result. These results suggest that the linkage between environmental performance and official promotion makes the successor local officials more motivated to implement differentiation strategies for the purpose of political promotion after taking office, so as to obtain political promotion opportunities. As a result, local officials not only pursue GDP growth, but also pay attention to environmental governance and environmental protection investment in their jurisdiction after environmental protection is incorporated into the performance evaluation index system. Thus, this means that Hypothesis 3 has been confirmed.

Table 4. Regression results.

Variable	*EEPI*	*Collusion*	*EEPI*	*Promote*	*EEPI*
	(1)	(2)	(3)	(4)	(5)
Turnover	0.0046** (2.42)	0.0560* (1.75)	0.0340*** (4.74)	0.0257*** (3.38)	0.5446*** (2.98)
Collusion			0.0448** (2.33)		
Promote					0.1376*** (3.38)
Size	0.0015*** (3.64)	0.0167** (2.25)	0.0012*** (3.02)	0.0004* (1.76)	0.0899** (2.12)
Lev	-0.0019*** (-3.48)	0.0536 (0.79)	-0.0001** (-2.22)	0.0022 (0.26)	-0.6254** (-2.38)
Roa	-0.0004** (-2.11)	0.0012 (0.36)	-0.0037* (-1.76)	0.0037 (0.29)	-0.0079* (-1.79)
Cash	-0.0142** (-2.17)	0.0051 (0.36)	-0.0037* (-1.88)	0.0137* (1.85)	-0.0582** (-2.25)
Growth	0.0222* (1.88)	-0.0132 (-0.69)	0.0037* (1.81)	0.0013 (0.68)	0.6813* (1.75)
Board	0.0032 (1.14)	0.0364 (1.11)	0.0016 (0.61)	0.0164 (0.53)	0.1802 (0.26)
Outdir	0.0106 (1.43)	0.0328 (0.55)	0.0042 (1.50)	0.0389 (0.47)	0.5248 (0.72)
Large	-0.0001* (-1.73)	0.0062 (0.37)	-0.0001* (-1.85)	0.0016 (1.03)	-0.0001* (-1.79)
Balance	-0.0002** (-2.08)	0.0345 (1.36)	-0.0003*** (-3.05)	0.0257 (1.36)	-0.0036** (-2.03)
Native	0.0142** (2.02)	0.1329** (2.20)	0.0242* (1.78)	0.2530*** (2.71)	0.0137** (2.21)
Age	0.0067** (2.46)	0.2023* (1.78)	0.0127** (2.01)	-0.1829** (-2.27)	0.0113** (2.19)
Edu	0.0048* (1.77)	0.0361* (0.89)	0.0056** (2.03)	0.1616*** (3.78)	0.0035* (1.77)
Constant	0.0294*** (2.76)	0.0543** (2.03)	0.0540** (2.02)	0.0685** (2.27)	0.0570*** (4.14)
Indu	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes
City	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.2051	0.1363	0.2497	0.2075	0.2560

Note: ***, ** and * indicate significance at the level of 1%, 5% and 10% respectively. t-statistics are in parentheses.

Robustness Test

Alternative Measures of EEPI

In this section, we sum up the assets and expenses related to the enterprise's environment in the note details of 'construction in progress' and the note details of management expenses in the enterprise's financial statements. Then, we obtain a new measurement method of EEPI (*EEPI1*) after the standardization of total assets. The results are presented in columns (1) of Table 5. The coefficient of *Turnover* is still significantly positive, which is consistent with the research conclusion of this paper. It is suggest that the relationship between the political turnover and EEPI is still robust.

Table 5. Robustness test.

Variable	*EEPI*1	*EEPI*
	(1)	(2)
Turnover	0.0029*** (2.67)	0.0058*** (3.14)
Size	0.0017* (1.88)	0.0548*** (2.63)
Lev	-0.0409** (-2.48)	-0.0784* (-1.78)
Roa	-0.0304** (-2.15)	-0.0106* (-1.95)
Cash	0.0242** (2.08)	0.0340* (1.83)
Growth	0.0246** (2.28)	0.0097* (1.75)
Board	0.0006 (0.35)	0.0039 (1.03)
Outdir	0.0204 (1.37)	0.0633* (1.79)
Large	-0.0012** (-2.04)	-0.0009* (-1.86)
Balance	-0.0540** (-2.11)	-0.0028* (-1.72)
Native	0.0056* (1.89)	0.0009** (1.99)
Age	0.0044* (1.71)	0.0043* (1.78)
Edu	0.0049* (1.72)	0.0052* (1.72)
Constant	0.0543*** (3.71)	0.9421*** (2.64)
Indu	Yes	Yes
Year	Yes	Yes
City	Yes	Yes
Adjusted R-squared	0.1546	0.1330

Note: ***, ** and * indicate significance at the level of 1%, 5% and 10% respectively. t-statistics are in parentheses.

Eliminate Some Enterprises

The samples include some enterprises that cross listed in A shares and H shares. Because these cross listed enterprises need to bear the dual responsibility of environmental information disclosure at home and abroad and face more stringent environmental supervision and judicial constraints. So, their environmental behavior decision-making may be the result of the comprehensive action of many factors. Therefore, we eliminate the 'A + H' cross listed samples to reduce the possible deviation of the research samples. The coefficient and significance of *Turnover* in columns (2) of Table 5 is similar to this in columns (1) of Table 4, demonstrating that the regression results are robust.

Moderating Effect

External environmental factors such as industry and regional differences may affect the relationship between political turnover and EEPI. Therefore, from the perspective of the market environment and ecological environment in which the enterprise is located, we make an effort to examine the moderating effects of two important external environmental factors, such as the degree of market competition and provincial environmental competitiveness, on the relationship between political turnover and EEPI.

Degree of Market Competition

A growing literature shows that the industry environment plays an important role in the production and operation decision-making of enterprises [55]. The differences of market environment and competition intensity in different industries have different effects on the development and operation of enterprises, which inevitably affect their investment decision-making behavior. It has been proved that the degree of industry competition has a positive impact on the level of environmental protection investment of enterprises [56]. Generally speaking, a good relationship between government and enterprises can bring the inclination of government resource allocation such as financing convenience and tax preference. So, the industry competitive environment of enterprises will affect their political rent-seeking motivation. And the profit margin of enterprises becomes smaller when the industry competition is fierce, which makes enterprises have stronger motivation to obtain more government support through establishing contact with the government. Therefore, enterprises take more initiative to show their strong sense of social responsibility to the successor local officials by increasing environmental protection investment, which leave a good impression on the successor officials and establish a good relationship between government and enterprises.

To test whether the degree of market competition affect the relationship between political turnover

and EEPI. Following Lu and Pan [57], we use the HHI index of Chinese enterprises to measure the degree of industry competition (*HHI*). According to the median of enterprise HHI index, it is equal to 1 if less than the median, and 0 otherwise. The results are shown in column (1) of Table 6. According to the results, we find that the coefficient of *Turnover×HHI* is positive and significant at the 5% level. It is consistent with our preceding argument that the degree of industry competition strengthens the positive relationship between the turnover of local officials and EEPI. The higher the degree of competition in the industry, the more motivated the enterprise is to respond to the environmental protection policies of the local government and produce differentiated products with environmental protection characteristics by using environmental protection facilities and green production technology to enhance its competitive advantage and win market recognition.

Provincial Environmental Competitiveness

The public goods attribute of the ecological environment determines that its governance effect needs the supervision of the central government. In the face of this pressure, local governments urge enterprises within their jurisdiction to strengthen environmental protection investment to improve regional environmental governance. Therefore, the level of provincial environmental competitiveness affects the implementation of environmental governance and environmental policies of local governments, and then affects the environmental protection investment level of enterprises in the jurisdiction. Local governments with high environmental competitiveness in the province can reduce the possibility of being held accountable by the central government for environmental protection problems because of their good environmental performance. Therefore, their objectives of governing the regional environment are easy to be replaced by other political objectives, resulting in a reduction in the enthusiasm of supervising the environment. Enterprises in the jurisdiction also adopt defensive environmental strategies to reduce environmental protection investment. On the contrary, local governments and enterprises with low provincial environmental competitiveness are facing strict environmental supervision by the central government, which urges local governments to strengthen environmental regulation policies in order to improve environmental protection in the short term. Meanwhile, enterprises also actively increase the scale of environmental protection investment and bear the responsibility of environmental governance to cater to the government's environmental supervision.

We further analyze the impact of provincial environmental competitiveness on the relationship between political turnover and EEPI. Following Deng et al. (2019), we obtain the ranking of environmental competitiveness of various provinces from 'the report on the development of comprehensive competitiveness of China's provincial economy'. And then , we construct a dummy variable (*PEC*) that equals 1 for the ranking is higher than the median and 0 for the ranking is lower than the median. The results are reported in Columns (2) of Table 6. The coefficient of *Turnover×PEC* is negative and significant at the 5% level, implying that

Table 6. Regression results of moderating effect.

Variable	*EEPI*	*EEPI*
	(1)	(2)
Turnover	0.0042*** (3.20)	0.0003* (1.67)
Turnover×HHI	0.0055** (2.56)	
Turnover×PEC		-0.0047** (-2.24)
HHI	-0.0007 (-0.65)	
PEC		-0.0003 (-0.25)
Size	-0.0014*** (-3.54)	0.0012*** (3.02)
Lev	0.0018*** (3.42)	0.0019*** (3.55)
Roa	-0.0017* (-1.71)	-0.0037 (-0.46)
Cash	0.0129* (1.87)	0.0147** (2.17)
Growth	-0.0002 (-0.09)	0.0003 (0.81)
Board	0.0035 (1.14)	0.0016 (0.64)
Outdir	0.0103 (1.18)	0.0084* (1.92)
Large	-0.0004 (-1.01)	-0.0001 (-0.95)
Balance	-0.0002** (-2.01)	-0.0002* (-1.90)
Native	0.0035* (1.77)	0.0029* (1.83)
Age	0.0018** (2.03)	0.0024** (2.16)
Edu	0.0052* (1.78)	0.0039* (1.85)
Constant	0.0413*** (3.50)	0.3280*** (3.27)
Indu	Yes	Yes
Year	Yes	Yes
City	Yes	Yes
Adjusted R-squared	0.0752	0.0744

Note: ***, ** and * indicate significance at the level of 1%, 5% and 10% respectively. t-statistics are in parentheses.

provincial environmental competitiveness has a negative moderating effect on the relationship between political turnover and EEPI.

Conclusion

This paper aims to examine the relationship between political turnover and EEPI, and the channels through which political turnover affects EEPI. We provide strong evidence that political turnover has a positive impact on EEPI. Moreover, collusive deterrence and official promotion incentive is the mechanism through which political turnover positively affects EEPI. On the one hand, the political uncertainty caused by the change of local officials has formed a certain deterrent to the original collusion between government and enterprises in the region, which leads to industrial enterprises reducing pollution emissions and increasing investment in environmental governance. On the other hand, new officials had to pay more attention to environmental governance and implement more and more strict environmental supervision based on the consideration of political promotion after environmental protection is incorporated into the performance appraisal system. In the robustness test, we confirm that results obtained in this paper are robust to alternative specifications. The results further show that the degree of market competition and provincial environmental competitiveness play moderating roles and have a strong impact on the political turnover between EEPI at different perspectives of the market environment and ecological environment. The degree of industry competition strengthens the positive relationship between the turnover of local officials and EEPI. While provincial environmental competitiveness has a negative moderating effect on the relationship between political turnover and EEPI. The research conclusion of this article not only helps to understand the relationship between political turnover and enterprise environmental behavior, but also has important significance for the improvement of cadre management and modern enterprise reform in China. The conclusion of this paper is based on data from the Chinese government and listed companies. Considering the characteristics of the legal system, we estimate that these conclusions apply to other countries using Continental Law System, such as Germany and Japan.

Based on the above results, this paper draws the following implications: (1) The environmental protection policies of the central government need to be implemented by local governments. Therefore, it is important for the Chinese government to further emphasize the importance of green performance appraisal and establish an official performance appraisal system with a coordinated economy and environment by bringing ecological protection and environmental governance into the scope of official performance appraisal. In this way, officials can pay more attention to environmental supervision within their jurisdiction and strengthen environmental protection investment. (2) The Chinese local government should use diversified methods such as administrative regulation and market incentives to enhance the awareness of corporate social responsibility, and actively promote energy conservation, emission reduction and environmental governance. Local governments should make greater effort to provide tax incentives, project support and government subsidies for enterprises to enhance their enthusiasm for environmental protection. As for firm governance, enterprises should also strictly abide by various environmental protection policies formulated by the government, increase environmental protection investment and reduce environmental pollution caused by production and operation activities. (3) The Chinese government must further reduce excessive government intervention in the market and accelerate the reform of the approval system and administrative examination. The continuous deepening of this reform will help to give full play to the role of the market in resource allocation and create a good market environment and ecological environment for enterprises to actively carry out environmental governance.

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Conflict of Interest

The authors declare no conflicts of interest.

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