Local Environmental Officials Change and Corporate Green Innovation

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Abstract. This paper analyzes the impact of environmental policy uncertainty caused by changes in local environmental officials on firms' green innovation within the theoretical framework of political cycle theory and promotion tournaments, and the impact of changes in local officials on firms' incentives to innovate by internalizing firms' environmental externality costs through two policy instruments: environmental regulations and environmental subsidies. On the other hand, subsidies are provided to firms for green innovation. On this basis, this paper tests the above theoretical analysis with a sample of A-share listed companies in China from 2010 to 2020. The study finds that the change of local environmental officials has a significant positive impact on corporate green innovation, and the positive impact is achieved by increasing environmental regulations and subsidies after the change of local environmental officials. In terms of heterogeneity, the change in local environmental officials has a positive effect on green innovation in non-state owned, non-eastern, and close regulatory proximity firms.

Keywords: Corporate Green Innovation; Local Environmental Officials Change.

1. Introduction

The 2022 Government Work Report proposes to "orderly promote the work of carbon peaking and carbon neutral", "implement the action plan of carbon peaking", "promote the research and development of green low-carbon technologies and the promotion and application The government will also build a green manufacturing and service system. The government formulated the text and introduced various policies to vigorously promote enterprise green innovation to provide a systematic reference.

According to the National People's Congress Environmental Resources Committee, environmental pollution costs China 283 billion yuan a year. During the "14th Five-Year Plan" period, ecological and environmental protection policies will continue to be improved, and the Ministry of Finance has issued a budget of 247.582 billion yuan for pollution prevention and control, and the country insists on matching capital investment with the task of pollution prevention and control. According to the China Ecological Environment Bulletin released by the Ministry of Ecology and Environment, 80% of exhaust gas, waste water and solid waste come from industrial enterprises. Enterprises are the cells of the national economy and the main producers of environmental pollution, so reducing environmental pollution to promote green innovation in enterprises has become a research hotspot for scholars to thoroughly solve the critical environmental problems in China.

On the one hand, the existing literature has studied corporate green innovation in terms of corporate executives' environmental experiences (Wang Hui, 2021), corporate executives' tenure (Cui Xiumei, 2021), corporate information disclosure (Li Chunfa, 2021), and corporate social responsibility (Liang Yunji, 2022), respectively, all of which strongly confirm the important influence of corporate internal factors in green innovation. However, these literatures have focused on the impact of firm internality and ignored the study of externalities impact. On the other hand, the existing literature has focused on the impact of environmental policy tools such as "two control zones" policy (Zhang Dongyang (2020), environmental tax (Yu Lianchao, 2019), environmental interview policy (Wang Xu, 2021), and environmental subsidies (He Xiaogang, 2014) on corporate green innovation in isolation, and few have included environmental regulation and environmental subsidies are included in the study at the same time. In addition, other scholars have incorporated theories such as

promotion tournaments (Zhou, L.A., 2007) and political cycle theory (Yu, J.W., 2015) into the study of corporate green innovation, with a preliminary focus on the influence of local officials on environmental governance as well as green innovation, but the existing literature is all about the change of governors and provincial party secretaries, with little focus on local environmental officials - -the director of environmental protection, a key environmental governance leader. Although the existing literature has studied corporate green innovation in more detail, it has not answered the question about the relationship between environmental policy uncertainty and corporate green innovation through the lens of changes in local officials.

In summary, this paper examines the impact of environmental policy uncertainty on firms' green innovation based on the evidence of local environmental officials' changes on a sample of A-share listed firms in China and analyzes its intrinsic mechanism in more detail. This study finds that local environmental officials, stimulated by promotion tournaments, will urge firms to engage in green innovation through active or strict environmental policies in order to improve environmental performance; exploring the intrinsic mechanisms from the perspectives of both environmental regulations and environmental subsidies finds that both environmental regulations and environmental subsidies are beneficial to firms' green innovation; media attention leads to externalities pressure on firms, which significantly moderates local environmental Media attention leads to externalities that significantly moderate the relationship between changes in local environmental officials and corporate green innovation; further research also finds that firms that are non-state owned, located in non-eastern regions, and in close regulatory proximity are more significantly influenced by changes in local environmental officials to promote corporate green innovation.

The research contributions of this paper are mainly in the following aspects: in terms of theoretical significance, it focuses on the impact of environmental policy uncertainty on corporate green innovation in the context of the institutional background of official changes in China, thus expanding the existing literature on corporate green innovation. In addition, the existing literature focuses more on provincial party secretaries and governors to explore the impact of official changes on environmental governance aspects, and less literature focuses on local environmental protection There is little literature that focuses on local environmental officials - environmental protection directors. The director of environmental protection is the main person responsible for carrying out the government's environmental responsibilities and enjoys an authoritative position in the local environmental protection system. This paper explores the relationship between environmental policy uncertainty and corporate green innovation based on evidence of changes in local environmental officials, and further expands the relationship between local officials' behavior and environmental governance; in terms of practical implications, this paper verifies the specific mechanisms by which environmental policy uncertainty affects corporate green innovation in terms of both environmental regulation and environmental subsidies, and provides theoretical support for the government to implement a flexible environmental policy. Theoretical Support.

The latter is organized as follows:Section 2 is a theoretical analysis; Section 3 is a description of the data and research design; Section 4 is an empirical test and analysis of the results; and Section 5 is a conclusion and implications.

2. Theoretical Analysis

2.1 Changes in Local Environmental Officials and Local Environmental Policies

According to promotion tournament theory and political cycle theory, after a change in local environmental officials, the new local officials generally take measures to promote local individual environmental performance by adopting more aggressive environmental policies. Promotion tournaments are a type of assessment designed by the Chinese government for officials at lower levels of government based on economically measurable indicators, and the winners of the competition are promoted (Zhou, Li-An, 2007). For local environmental officials, their main responsibility is to promote the implementation of central environmental policies and to monitor and punish local

pollution, so the main performance assessment of environmental officials is the environmental performance of individual local economies. Therefore, local environmental officials have an incentive to implement more aggressive environmental policies to improve environmental performance in order to be promoted. In addition, according to political cycle theory, the cyclical nature of party congresses as political elections makes local government behavior also characterized by cycles, and although party congresses follow a universal election cycle while official changes are unanticipated events that can also occur in non-universal election cycles, and the two cycles do not exactly coincide (Yu, Jingwen, 2015), the new cycle of assessment by the new leadership elected by party congresses is usually expected As a result, the economic performance of incumbent officials relative to their predecessors affects their chances of political advancement under the incentive of promotion tournaments, and new officials strive to perform in their new term of office (Chen, 2012). The two main policy tools used by local environmental officials for local environmental governance are environmental regulation and environmental subsidies, of which: environmental regulation is to increase environmental regulation at the regional level and to promote environmental governance by imposing emission fees on enterprises; environmental subsidies are to increase environmental support at the regional level and to promote environmental governance by giving more environmental subsidies to enterprises.

Based on the above analysis, the following research hypotheses are proposed in this study, respectively:

H1: There is a positive impact of local environmental officials change on corporate green technology innovation

2.2 Changes in Local Environmental Officials, Local Environmental Policies and Corporate Green Technology Innovation

On the one hand, motivated by promotion tournaments, new environmental officials may promote local individual environmental performance by increasing the intensity of environmental regulations, i.e., by setting stricter environmental standards, strengthening government environmental regulation, and other measures to restrain enterprises from polluting the environment. The indicators of environmental performance are relatively implicit, and the externalities of environmental pollution lead to the fact that the management of environmental pollution is not immediate. In order to surpass the performance of the previous environmental officials, new environmental officials may implement stricter environmental regulations at the beginning of their tenure in order to achieve a higher environmental performance by improving the local environment during their tenure. Jun Hu (2019) finds that the year in which a change in environmental protection director occurs, environmental regulation in his control area is significantly enhanced, and environmental expenditures of firms increase under reasonable environmental pressure. Fan Qingquan (2018) found that local environmental regulation has a significant contribution to environmental governance. Shen Hongtao (2012) argues that the environmental governance role of regulatory instruments such as raising the standards of local environmental protection and enhancing government regulation is effective, thus urging firms to fulfill their social responsibility and strengthen green innovation.Porter and Van Der Linde (1995) find that appropriate environmental regulation policies force or prompt firms to increase their R&D investment to improve their products through green Porter and Van Der Linde (1995) found that appropriate environmental regulation policies would force or motivate enterprises to increase R&D investment, improve the technological content of products and their pollution control ability through green technological innovation or technical innovation, thus promoting green development and transformation and upgrading of enterprises. In summary, the government pushes enterprises to increase more R&D investment in green innovation through a series of environmental policies, so as to improve their own green innovation level to cope with environmental regulations.

On the other hand, new officials may also promote green innovation by increasing environmental subsidies. Environmental subsidies reduce the burden of environmental responsibility on firms and provide incentives for green innovation. After a change in local environmental officials, new

environmental officials are more inclined to improve environmental performance through short-sighted policy instruments in order to obtain better performance than their predecessors as soon as possible within their limited tenure, and therefore mobilize their resources for expansionary fiscal policies at the beginning of their tenure. He Xiaogang (2014) found that different environmental policies have different effects on R&D investment in green technology innovation, and the study suggests that government subsidies do compensate to some extent for the lack of incentives for firms to innovate green technology. According to Cheng and Bo (2021), environmental regulations turn the externalities caused by environmental pollution into internal costs for enterprises and increase their costs, which will weaken their willingness to invest and thus reduce their investment in green innovation even more from both cost and benefit perspectives, and if the government gives certain environmental subsidies, it will not only reduce the pressure on enterprises but also reduce their marginal environmental management If the government gives certain environmental protection subsidies, it can not only reduce the pressure of enterprises but also reduce the marginal cost of environmental management. In conclusion, green innovation is different from other innovations in that it has high cost, high risk, and positive externalities of R&D results, etc. Government subsidies for environmental protection can reduce the R&D costs of enterprises and reduce the market failure caused by technology spillover, increase the willingness of enterprises to carry out green innovation activities, and thus stimulate enterprises to carry out green innovation and improve the efficiency of environmental management.

Based on the above analysis, two research hypotheses were proposed separately in this study :

H2a: Local environmental officials change to promote corporate green innovation through increased environmental regulation.

H2b: Local environmental officials change is to promote corporate green innovation by increasing environmental subsidies.

Based on the existing literature and reality, this paper argues that there are two possible channels for local environmental officials to influence firms' green innovation: first, environmental regulation, by imposing emission fees on firms to promote their environmental management; and second, environmental subsidies, by giving firms more environmental subsidies to promote their environmental management.

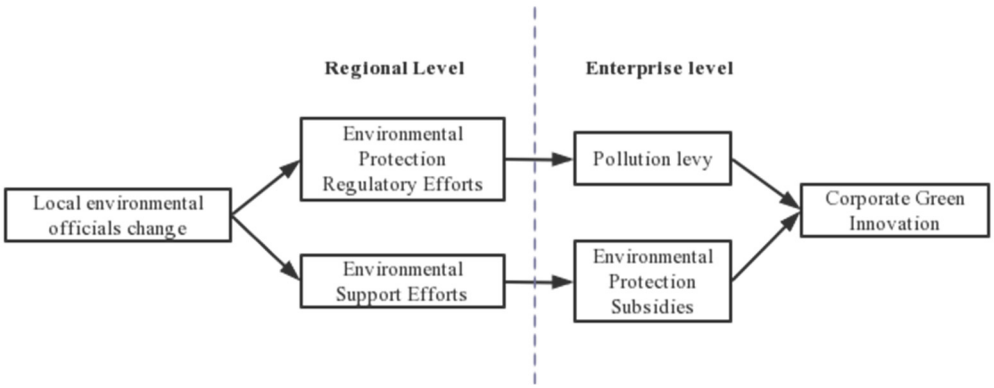


Figure 1. Mechanism of action framework

3. Data Description and Study Design

3.1 Sample Selection

In this paper, we select A-share listed companies in China from 2010 to 2020 as the initial research sample. The above time selection range is mainly based on the following two considerations: First, after the 18th Party Congress, more attention was paid to the concept of green development and the construction of ecological civilization was unprecedented. Second, information on changes in local environmental protection officials before 2010 is incomplete, and there is a lack of specific

information about the directors on the official websites of provincial environmental protection departments across the country, and it is difficult to obtain their details from other public websites, which may lead to erroneous measurements about environmental policy uncertainty. Therefore, the sample time range selected for this paper is from 2010 to 2020. In the data processing, the industry affiliation is determined according to the industry codes specified in the Industry Classification Guidelines for Listed Companies (2001 Revision) of CSRC, and the province affiliation is determined according to the province of the office of listed companies provided by CSMAR database. Drawing on the practice of existing studies, the initial samples were screened according to the following criteria: (1) excluding samples from financial and real estate industries; (2) excluding samples that had been ST or ST*; (3) excluding samples with missing relevant variables. After the above sample processing, a total of 21317 company annual observations were obtained.

3.2 Variable Definition and Data Description

Table 1. Variable design and description

Variable Name	Variable Symbol	Variable Meaning and Description
Local Environmental Protection Officials	LEPOC	Change of environmental protection officials in the province where the company's office is located, yes is 1, no is 0
Enterprise Green Innovation	LnGreen	Ln(the total number of green patent applications of listed companies +the total number of green patent authorization+ 1)
Environmental regulation	ER	Combined index of pollutant emissions in a city Environmental subsidies
Environmental subsidy	Envsub	Environmental subsidies = (government environmental subsidies / total business income) × 100
Size	Lnsize	Ln(the company's total assets)
Age	Lnage	Ln(the number of years the company has been listed)
Lev	Lev	Ratio of total liabilities to total assets
R&DPersonRatio	RDPR	R&D personnel as a percentage of total employees
RDSpendSumRatio	RDSSR	R&D investment as a percentage of operating revenue
Top1	Top1	Shareholding ratio of the largest shareholder of the company
Labor	LnL	Ln(the number of employees)
IndDirRatio Independent directors ratio	INDDIR	Ratio of independent directors to the number of board of directors
ROA	ROA	Net profit/total assets
Tang	Tang	(Net Fixed Assets + Net Inventory)/Total Assets

3.3 Model Design

In order to test the impact of the change of local environmental officials on corporate green innovation, the following empirical model is constructed:

$$\mathrm{LnGreen}_{ijt} = \alpha_0 + \alpha_1 \mathrm{EPOC}_{jt} + \mathrm{X}_{it}\beta + \gamma_i + \delta_j + \eta_t + \epsilon_{it} \quad (1)$$

where i represents the individual firm; j represents the city where the firm is located; t represents the time year; LnGreen represents the firm's green innovation; and LEPOC represents the local environmental protection officer change;X_{it} represents firm-level control variables; γ_i represents individual fixed effects; δ_j represents regional fixed effects; η_t represents year fixed effects.

4. Empirical Tests and Analysis of Results

4.1 Descriptive Statistics

The results of descriptive statistics for the main variables are shown in Table 2. The mean value of corporate green innovation (LnGreen) is 2.120, the median value is 1.946, the minimum value is 0.693, and the maximum value is 7.534, indicating that there are significant differences in the level of green innovation among different companies, showing a trend of polarization. The mean value of local environmental protection officials change (LEPOC) is 0.195, indicating that about 19.5% of the sample has local environmental protection officials change. The mean value of firm size (Lnsize) is larger than the median, and the data shows a right-skewed distribution characteristic. This data distribution feature indicates that most of the firms are of low size and below average, while a few other firms are of higher size than others. The mean value of firm's age at IPO (Lnage) is approximately the same as the median, indicating that the firm's age at IPO may obey a normal or approximately normal distribution. The standard deviation of R&D staff ratio (RDPR) is too large, indicating that the proportion of R&D staff varies widely among companies. The standard deviation of R&D investment ratio (RDSSR) is too large, which indicates that there is a large difference in R&D investment among different companies.

Table 2. Results of descriptive statistics of the main variables

Variables	Sample size	Average value	Median	Minimum value	Maximum value	Standard deviation
LnGreen	21354	2.120	1.946	0.693	7.534	1.206
LEPOC	45015	0.195	0.000	0.000	1.000	0.396
Lnsize	45070	22.40	22.19	13.08	28.64	1.458
Lnage	45129	2.091	2.303	0.000	3.434	0.902
Lev	45070	0.456	0.440	-0.195	63.97	0.507
RDPR	27740	18.16	13.10	0.000	11066	134.7
RDSS	36612	5.797	3.730	0.000	31729	166.0
Top1	45053	0.348	0.326	0.003	0.900	0.154
LnL	45035	7.867	7.779	0.693	13.22	1.373
Id	45035	-6.557	-6.486	-11.78	1.609	1.350
Roa	45070	0.0360	0.0370	-48.32	108.4	0.606
Tang	44867	0.354	0.338	0.000	0.971	0.173

4.2 Baseline Return

The results of the study based on column (1) of Table 3 show that without adding any control variables, the change in local environmental officials has a significant positive impact on corporate green innovation with an impact coefficient of 0.180, which passes the significance test at the 1% level. The regression results in column (2) of Table 2 show that the change in local environmental officials has a significant positive effect on corporate green innovation with a coefficient of 0.160, which passes the significance test at the 1% level, when further adding control variables to examine the effect of change in local environmental officials on corporate green innovation. Finally, adding individual, year, and region fixed effects, the regression results in column (3) of Table 2 show that the change in local environmental officials has a significant positive impact on corporate green

innovation with an impact coefficient of 0.036, which passes the significance check at the 1% level, implying that the change in local environmental officials strengthens corporate sustainability and stimulates companies to better cater to the green orientation of external stakeholders, thus promoting green innovation. Therefore, the hypothesis H1 of this paper is confirmed by the empirical results.

Table 3. Baseline regression results of the change in local environmental officials on corporate green innovation

	(1) LnGreen	(2) LnGreen	(3) LnGreen
LEPOC	0.180***	0.160***	0.036***
	(8.901)	(8.203)	(2.901)
Lnsize		0.423***	0.208***
		(34.921)	(6.727)
Lnage		-0.086***	-0.028
		(-7.170)	(-0.821)
Lev		0.351***	-0.234***
		(7.093)	(-5.121)
RDPR		0.000	-0.000
		(0.539)	(-0.741)
RDSSR		0.017***	0.001
		(8.964)	(0.258)
Top1		-0.357***	0.269*
		(-5.947)	(1.921)
LnL		0.087***	0.166***
		(2.636)	(4.493)
Id		-0.004	-0.025
		(-0.117)	(-1.126)
Roa		0.157*	-0.196***
		(1.677)	(-2.875)
Tang		-1.114***	0.106
		(-19.062)	(1.008)
_cons	2.085***	-7.819***	-4.046***
	(224.934)	(-39.564)	(-6.998)
Control variables	No	Yes	Yes
Individual FE	No	No	Yes
Year FE	No	No	Yes
Regional FE	No	No	Yes
N	21317	13843	13391

4.3 Robustness Tests

4.3.1. Replace Tobit Model

When using the number of green patent applications as the explanatory variable, this paper uses Tobit model for analysis because more enterprises do not apply for green patents. According to the results in column (1) of Table 5, the regression coefficient of change of local environmental officials on green innovation of enterprises is 0.034, which passes the significance test at 1% level, indicating that change of local environmental officials significantly promotes green innovation of enterprises.

4.3.2. Endogenous Problems

To better deal with endogeneity, this paper refers to the method of Chen, Deqiu et al. (2016) to address the sample selection bias. Therefore, in the following paper, we try to use the PSM method. In this paper, the sample in which the officials changed is used as the treatment group, and the set of control variables described in the previous section is used as the matching variable to find a control group with similar characteristics for the treatment group by one-to-one nearest neighbor matching and Kernel kernel matching methods, and then OLS regression is performed on this basis.

Table 4 shows the results of the propensity score matching for the full sample, with a t-test value of 8.26 before matching and 7.68 after ATT, with significantly lower values. This indicates that the firms in the area where the local environmental officials changed after matching are more comparable.

Table 4. Table of treatment effects for propensity score matching

Explained variables	Processing effects	Motivation group	Control group	Gap	Standard error	T-test value
Corporate Green Innovation (LnGreen)	Before matching	2.3214	2.1291	0.1922	0.0232	8.26
	ATT	2.2425	1.9240	0.3185	0.0415	7.68

In column (2) of table 5, the results of the regression after PSM propensity score matching show that the change in local environmental officials has a significant positive impact on corporate green innovation with an impact coefficient of 0.034, which passes the significance test at the 10% level.

Table 5. Tobit model test and regression results after PSM propensity score matching

	(1) LnGreen	(2) LnGreen
LEPOC	0.034***	0.034*
	(2.951)	(1.947)
_cons	-4.333***	-3.850***
	(-8.145)	(-3.911)
Control variables	Yes	Yes
Pseudo R^2	0.589	0.694
Individual FE	Yes	Yes
Year FE	Yes	Yes
Regional FE	Yes	Yes
N	13843	5512

4.4 Mechanism Testing

According to the regression results in column (1) of Table 6, the coefficient of the effect of the change of local environmental officials on environmental regulation is 0.013, which passes the significance test and the hypothesis H2a of this paper is confirmed, implying that the change of local environmental officials has a positive promoting effect on environmental regulation. This indicates that after the change of local environmental officials, the new environmental officials may restrain enterprises from polluting the environment by enhancing the supervision of environmental protection departments and setting stricter environmental standards, and under reasonable environmental pressure, enterprises will increase their R&D expenditures accordingly, thus promoting green innovation. This results in a positive path of "change in local environmental officials → environmental regulation → corporate green innovation".

According to the regression results column (2) in Table 6 shows that the coefficient of influence between the change of local environmental officials and environmental subsidies is 0.001, which passes the significance test and the hypothesis H2b of this paper is confirmed, implying that the change of local environmental officials has a positive promoting effect on environmental subsidies. This suggests that after the change of local environmental officials, the new environmental officials may adopt environmental subsidies to help companies reduce the burden of R&D and the marginal cost of environmental management, and when companies receive environmental subsidies, they will be more motivated to engage in green innovation. This results in a positive path of "change in local environmental officials → environmental subsidies → corporate green innovation".

Table 6. Impact mechanism test

	(1) ER	(2) Envsub
LEPOC	0.013**	0.001**
	(1.986)	(2.314)
Lnsize	-0.026*	-0.002
	(-1.893)	(-1.197)
Lnage	0.002	0.000
	(0.196)	(0.022)
Lev	-0.023	-0.002
	(-1.141)	(-0.485)
RDPR	-0.000	0.000
	(-0.034)	(0.558)
RDSSR	0.000	0.000*
	(0.053)	(1.901)
Top1	0.106	-0.001
	(1.590)	(-0.126)
LnL	0.006	-0.002
	(0.345)	(-1.273)
Id	-0.001	-0.002*
	(-0.069)	(-1.731)
Roa	0.024	-0.012**
	(0.948)	(-2.262)
Tang	-0.037	-0.001
	(-0.864)	(-0.142)
_cons	0.556**	0.042*
	(2.237)	(1.714)
Individual FE	Yes	Yes
Year FE	Yes	Yes
Regional FE	Yes	Yes
N	25974	5931

4.5 Heterogeneity Analysis

4.5.1 Property Heterogeneity

According to the results, in the sample of state-owned enterprises, the coefficient of influence of local environmental officials' change on corporate green innovation is -0.014, which fails the significance test and has a negative influence instead; in the sample of non-state-owned enterprises, the coefficient of influence of local environmental officials' change on corporate green innovation is 0.064, which passes the significance test at the 1% level, implying that in non-state-owned enterprises local environmental officials The coefficient of 0.064 passed the significance check at the 1% level, implying that the change of local environmental officials has a significant positive impact on green innovation in non-state enterprises. The results show that the positive impact of local environmental officials' change on green innovation is mainly found in non-state owned enterprises.

According to the results, in the sample of companies located in the east, the coefficient of influence of the change of local environmental officials on corporate green innovation is 0.019, which does not pass the significance test; in the sample of companies located in the non-east, the coefficient of influence of the change of local environmental officials on corporate green innovation is 0.063, which passes the significance test at the 1% level. The results indicate that the positive effect of the change of local environmental officials on corporate green innovation is mainly found in non-eastern firms.

The office of the enterprise belongs to the provincial capital city, assigned as 1, 0 if not. According to the results, in the sample of enterprises with close regulatory distance, the coefficient of influence of the change of local environmental protection officials on the green innovation of enterprises is 0.096,

which passes the significance test at the 1% level; in the sample of enterprises with far regulatory distance, the coefficient of influence of the change of local environmental protection officials on the green innovation of enterprises is 0.038, which does not pass the significance test. The results show that the positive effect of local environmental officials' change on green innovation is mainly reflected in the enterprises with close regulatory distance.

Table 7. Regression results of different regions on green innovation of enterprises

	(1)	(2)	(3)	(4)	(5)	(6)
	State-owned	Non-State	East	Non-Eastern	Regulatory proximity	Long regulatory distance
	LnGreen	LnGreen	LnGreen	LnGreen	LnGreen	LnGreen
LEPOC	-0.014	0.064***	0.019	0.063***	0.096***	0.038
	(-0.708)	(3.919)	(1.248)	(2.717)	(3.176)	(1.333)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes
_cons	-2.866***	-5.673***	-3.426***	-5.011***	-2.673	-4.857***
	(-2.736)	(-7.423)	(-4.926)	(-4.356)	(-1.574)	(-3.217)
N	5138	8151	10049	3341	2017	1839

5. Inclusions

This paper empirically examines the impact of local environmental officials' change on corporate green innovation, using A-share listed companies in China from 2010 to 2020 as the research sample. The main findings of this paper are as follows: (1) changes in local environmental officials have a significant positive impact on corporate green innovation, and this result indicates that under the political cycle theory and promotion tournament system, changes in local environmental officials bring about more active environmental policy measures and significantly affect corporate green innovation behavior; (2) the mechanism test finds that when changes in local environmental officials occur, on the one hand, the intensity of local environmental On the other hand, the intensity of environmental subsidies also increases, which reduces R&D costs and market failures due to technology spillover, thus increasing enterprises' willingness to carry out green innovation activities.

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