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The role of environmental justice reform in corporate green transformation: Evidence from the establishment of China's environmental courts

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Purpose: The establishment of environmental courts in China provides a good opportunity to explores the economic effects of environmental justice reform. This paper investigates how the environmental justice reform can influence corporate green transformation from the perspective of green technology innovation and explores the potential mechanisms of how the environmental courts affect green technology innovation. The heterogeneous effects of environmental courts are also considered.

Methodology: Using the establishment of environmental courts in China as a quasi-natural experiment, this paper adopts a difference-in-difference (DID) method to conduct empirical test based on data on Chinese listed A-shared firms from 2004 to 2019. Moreover, this paper use propensity score matching (PSM), tobit and negative binomial regression method to address possible estimation bias.

Findings: The establishment of environmental courts significantly enhances green technology innovation among enterprises. The more effective judicial enforcement and better public awareness of the environment brought by the environmental courts will increase the cost of illegality and external supervision pressure for firms, which will lead firms to innovate in green technology. Furthermore, the positive and significant effect of environmental courts on green technology innovation is more pronounced in state-owned enterprises (SOEs) and enterprises located in regions where local protectionism is more serious or regions with more ideal environmental legal system.

KEYWORDS

environmental court, environmental litigation, public supervision pressure, difference-in-difference method, green technology innovation

1 Introduction

Along with the rapid industrial and urban developments in China, environmental problems have gradually become major constraints that hinder its sustainable development. According to the Bulletin of China's Ecological Environment in 2016, only 99 out of 338 cities at the prefecture level and above met environmental air quality standards, and 32.3% of surface water and 60.1% of groundwater are classified as class IV or below which refer to the water polluted or not suitable for human consumption[1]. Serious environmental degradation caused heavy burdens and losses to

1 The relevant information and data can be accessed at https://www.mee.gov.cn/hjzl/sthjzk/

China's social development and economic production (Zhou et al., 2021). In response to the economic and environmental challenges, the Chinese government has issued multiple policies and regulations, such as Emission Trading System and adoption of New Ambient Air Quality Standards in China, to achieve an environmentally friendly development model (Du and Li, 2020; Peng et al., 2021; Zhang et al., 2022). In this context, as the main body of environmental pollution in the process of industrialization, the traditional production mode of enterprises bears considerable responsibility for environmental pollution, and its green transformation is imperative. The essential factor of enterprise green transformation is green technology innovation.

Green technology innovation is regarded as an effective way to solve the contradiction between environmental degradation and economic development (Rennings, 2000; Wang et al., 2021). And it refers to the creation and adoption of new industrial production technologies and systems that contribute to pollution abatement, resource utilization, and energy efficiency rather than traditional environmentally neutral innovation (Kammerer, 2009; Cai et al., 2020; Ma et al., 2022). Through green technology innovation, enterprises can reduce the negative impact on the environment and balance economic production and environmental protection (Ghisetti and Quatraro, 2017; Li et al., 2018; Yang et al., 2021). Inducing green technology innovation in enterprises and improving green production efficiency has received extensive attention from the government and academia.

Presently, scholars mainly focus on the impact of environmental policies and regulations on green technology innovation and how these measures accelerate the green transformation of the industry (Stoever and Weche, 2018; Tao et al., 2021). However, they ignore that environmental justice may also play an important role in green technology innovation. In recent years, environmental judicial reform is attracting more attention from the Chinese government and society. Statistics show that since 2005, the disputes over environmental issues have increased by more than 30% annually (Fan et al., 2019). However, under the traditional judicial system in China, due to the public goods attributes of environmental pollution, judgments in environmental cases are often controversial because of their complexity, which tends to cause unnecessary loss of the environment and social resources. Therefore, pollution disputes involving enterprises often cannot be reasonably resolved due to the lack of environmental judicial capacity, which is not conducive to the green development of enterprises. It can be seen that environmental justice not only plays a role in protecting the environment but also has an impact on social production. In addition, a sound environmental judicial system can also guarantee the implementation and applicability of environmental policies (Liang and Gao, 2014).

In China, judicial reform and improvement represented by environmental courts are one of the government's important environmental governance measures. China's first exploration of judicial reform began in 2007. To resolve local pollution disputes, the government established the first environmental court in the Intermediate People's Court (IPC) of Qing Zhen City, Guizhou Province, in 2007. In December of the same year, the Qingzhen Environmental Court rendered its verdict public on the Tianfeng Chemical Factory case, the first public interest environmental litigation in China. Since then, the local environment there has been effectively improved.

The win-win situation of environmental protection and economic development is the ultimate goal of environmental judicial reform. After effectively eliminating the negative externalities of enterprises to the environment, a question worth further exploration is whether environmental courts will have any impact on the production behavior of enterprises, is the impact positive or negative? As green technology innovation is a key factor for enterprises to realize green and sustainable development, it has great theoretical and practical significance to explore the relationship between environmental courts and green technology innovation.

To better identify the causal effect of environmental justice reform on green technology innovation, we take the establishment of environmental courts as a quasi-natural experiment and adopt the DID approach to investigate the real impact of environmental courts on corporate green technology innovation. DID is an econometric method in a quasi-experimental design form commonly used by economists to evaluate the economic effects of shocks from policy or other unexpected events (Fang et al., 2022). Through data from the treatment and control groups, we can use the DID model to construct appropriate counterfactuals to estimate the true causal effect after the shock occurred, that is, to compare the change over time in outcomes between a group affected by the shock (the treated group) and a group that is not (the control group). On this basis, we also consider the potential mechanisms of how the environmental courts affect green technology innovation. Relying on a mediating effect model, we shed light on the potential mechanisms from perspectives of environmental litigation risk and public awareness. Furthermore, we explored the heterogeneous effects conditional on local law environment, government intervention, and firms' ownership to gain a more comprehensive understanding of the impact of environmental courts on green technology innovation. In addition, we performed a series of robustness checks to verify the validity of the results.

The contribution of our paper lies in the following aspects. First, we contribute to the literature on drivers for green transformation (Chen, 2008; Li and Sheng., 2018). Previous studies overwhelmingly focus on the impacts of environmental regulation on green innovation (Lanoie et al., 2008; Ambec et al., 2020; Fang et al., 2022), with the absence of consideration for the environmental judicial system. Our paper fills a literature gap by researching judicial factors that drive green technology innovation and highlights the critical role played by an environmental court. Our paper provided new empirical evidence that environmental courts can significantly enhance corporate green technology innovation. Second, for the stream of relevant literature on environmental justice, scholars have concentrated on the relationship between the environmental court and pollution abatement or firms' business behaviors (Zhang et al., 2019; Huang et al., 2022). Our paper not only enriches this stream of literature by focusing on green technology innovation using firm-level data but also reveals the underlying mechanisms of how environmental courts affect green technology innovation, which enables us to provide targeted policy recommendations concerning both the environment and firm green transformation.

The rest of this paper is arranged as follows. Section 2 presents the literature review. Section 3 introduces the institutional background and theoretical analysis. Section 4 introduces the econometric methodology and describes the data. Section 5 shows the benchmark analysis of the green technology innovation effect of environmental courts. Section 6 explore the

underlying mechanisms. Section 7 presents the results of further analysis. And the final section concludes.

2 Literature review

In the field of environmental economics, the relationship between environmental regulation and green technology innovation has always been a perennial topic attracting scholars. Porter and Van der Linde (1995) emphasized that moderate environmental regulation can guide the direction of technological advancement of enterprises and enhance their green technology innovation ability, so as to gain competitive advantages, which is also the famous "Porter Hypothesis." In the long run, green innovation can bring stable earnings to enterprises and compensate for the cost caused by environmental regulations, thus improving productivity. Mohr and Saha (2008) derive results consistent with the "Porter Hypothesis" through a general equilibrium framework. They point out that environmental regulation may encourage enterprises to invest in green technologies, which is conducive to exploiting firms' capacity to innovate. Fang et al. (2022) reported similar findings. They study the impact of the New Environmental Protection Law (NEPL) in China and find NEPL brings supervision pressure to heavily polluting firms, prompting them to improve the quality of information disclosure, thus improving green innovation. "Porter Hypothesis" is not always valid. Due to the heavy pressure of pollution abatement cost brought by environmental regulation, enterprises may be unable to support more environmental R&D investment, thus hindering the green transformation of enterprises. For example, Stoever and Weche (2018) used the Difference-in-difference model to investigate the impact of Germany's water environmental protection policy on firms' competitiveness. In this regard, they found that the policy inhibited enterprise performance and investments in environmental protection, which is not conducive to their green development. Fan et al. (2021) suggest that environmental regulation will force enterprises to invest more in environmental protection equipment and pollution treatment costs, which will crowd out productive investment to a certain extent, making it unfavorable to urban green development in China. In addition, scholars have found that there may be a non-linear relationship between environmental regulation and green innovation. Domazlicky and Weber (2004) studied the pulp, paper and chemical industries in the United States and found that the impact of environmental regulation on innovation efficiency was uncertain in different industries. And environmental regulation may not only lead to potential output losses, but may also reduce pollution while increasing output. Li and Du (2021) examined the spatial spillover effect of environmental regulations on green innovation efficiency based on Chinese city-level data. The results show that significant spillover effects of environmental regulations on urban green innovation efficiency are reflected in a U-shaped impact that was first suppressed and then promoted.

The above literature explored the effects of government environmental governance on technical innovation from the perspectives of environmental policies and environmental supervision, but they ignored the impact of environmental justice. As a representative measure of environmental judicial reform, Environmental courts have proven to be an effective way to resolve environmental disputes and litigation (Jacobs, 2006; Almer and Goeschl, 2010). Pearlman (2000) described the Land and Environment Court of New South Wales in Australia, he gave various examples in key areas such as environmental prosecution, public participation in environmental protection and decision-making, and transboundary pollution to demonstrate the value of specialist judges and the role of environmental courts in the evolution of case law in environmental jurisprudence. Yu (2017) state that the environmental courts in China take four forms: Environmental protection tribunal, Collegial panel for environmental protection, Circuit court for environmental protection, and Courts for grassroots environmental protection. He also pointed out that China's environmental courts still have some shortcomings, such as a lack of institutional structure and professional judges. In addition, some scholars also studied the economic effect of environmental courts. Zhang et al. (2019) evaluate the effects of environmental justice reform on environmental governance at the firm level and find environmental courts significantly enhance the firms' environmental investment. Huang et al. (2022) investigate the relationship between environmental courts and foreign direct investments. They find the foreign direct investments of cities with environmental courts would drop by 3.32% from the average, which is consistent with the "Pollution Heaven Hypothesis."

Although the research findings on exploring the relationship between environmental regulation and green technology innovation are relatively abundant, there is a lack of systematic examination from the perspective of environmental justice reform represented by environmental courts. A sound environmental judicial system should not only contribute to the implementation of environmental laws and regulations but also provide positive guidance to the production behavior of enterprises. Therefore, our paper aims to add new empirical evidence on the impact of environmental justice reform on promoting green technology innovation.

3 Institutional background and theoretical analysis

3.1 Institutional background

Since the promulgation of the "Environmental Protection Law of the People's Republic of China" in 1989, the central and local legislative departments have passed hundreds of laws and regulations (Liu and Chen, 2016) to promote the existence of laws to be abide by. However, in the face of environmental violations, the public and no-profit organizations lack appropriate litigation channels, and the trial results of environmental disputes are often controversial due to the complexity of environmental issues. It can be seen that although the legal system has gradually improved, the environmental judicial processing capacity that matches it does not match.

On the one hand, under the traditional Chinese legal system, environmental cases have long been governed by three traditional

categories of criminal, civil, and administrative cases according to their specific circumstances. Due to the typical negative externality and public goods attributes of environmental pollution, it is often difficult to have a unified standard and punishment intensity for the treatment of environmental cases in the traditional judicial system. At the same time, the investigation and evidence collection process of environmental protection cases have higher requirements on the professional background of the adjudicators, and the judges under the traditional court system mostly hear ordinary criminal, civil or administrative cases, which inevitably improperly grasp the application of the law when trying environmental resource cases, resulting in errors and affecting the fairness of environmental cases (Wang, 2014; Wang and Feng, 2014).

On the other hand, the public's environmental awareness and demand for environmental protection are increasing by the day. Environmental disputes in China have increased by more than 20 percent a year since 1998, but China's traditional legal system has failed to provide adequate legal protection for public or non-profit organizations. Under the traditional judicial system, environmental cases are difficult to be characterized, people often struggle to find appropriate division to initiate litigation. Even with successful appeals, environmental cases are usually linked to public interests because of the public goods attributes of the environment, so it is difficult to clearly define the legal rights and interests related to the appeal, thus forming effective support for environmental protection. As a result, the traditional judicial system is to some extent no longer applicable in solving environmental litigation.

To solve the dilemma of environmental justice, an important institutional exploration is to set up environmental courts to carry out judicial specialization reform (Edwards, 2013). The environmental court unifies and centralizes the decentralized jurisdiction of environmental resource cases in the traditional court system, and improves the trial efficiency of environmental pollution liability disputes by enhancing the professional level of environmental justice, forming a strong constraint on resource waste and environmental pollution (Edwards, 2013; Carnwath, 2014). In November 2007, the country's first environmental court was established in Qingzhen, Guizhou Province, which was identified by the Supreme People's Court as one of the first "environmental judicial practice bases" in China[2]. The environmental court established an environmental expert advisory committee to reduce false trials and improve the efficiency of judicial handling of environmental cases. In July 2014, the Supreme People's Court established the Environmental and Resources Division in conjunction with the release of the "Opinions on Comprehensively Strengthening Environmental Resources Trial Work to Provide Effective Judicial Guarantee for Promoting Ecological Civilization Construction." These measures guide the promotion of judicial specialization and further provide a guarantee for the impartiality of environmental justice.

Hereafter, under the guidance of the Supreme People's Court, most of the provinces started to establish environmental courts. By the end of 2019, more than 100 environmental courts have been established across 20 provinces and municipalities in the country[3]. According to the "Trial of China's Environmental Resources (2019)" issued by the Supreme People's Court, the number of environmental resource trials has rapid growth and the efficiency of environmental justice has improved significantly compared with previous years.

3.2 Theoretical analysis

The "Porter hypothesis" points out that appropriate and reasonable environmental regulation will induce enterprises to innovate (Porter, 1991; Porter and van der Linde, 1995). The positive effect brought by this green-oriented innovation will compensate for the negative effect of the environmental cost that enterprises need to pay, and ultimately ease the dilemma between production and environmental degradation. Intuitively, the environmental court promotes the efficiency of environmental justice and law enforcement, directly or indirectly increasing the cost of environmental violations for enterprises that force them to carry out green technology innovation and improve production methods. First of all, the environmental court has unified the decentralized jurisdiction of environmental disputes in the traditional court system. The formation of such judicial specialization can greatly promote the efficiency of the trial of environmental pollution disputes, and effectively restrain the waste of resources and environmental pollution. Secondly, after the establishment of the environmental court, it usually adopts the mode of "trial-execution combination." This mode can greatly improve the traditional court's "only judgment without decision" situation in environmental cases and enhance judicial enforcement. Further, environmental courts endowed with direct enforcement power can also effectively alleviate the dilemma that the local environmental protection department has no enforcement power over polluting enterprises or is even interfered with by the local government. For polluting enterprises that seriously violate environmental regulations, the environment courts can use legal means such as seizure, detention, and property freezing to ensure that the enterprise abides by environmental judgments. Therefore, when enterprises face more efficient law enforcement brought by environmental courts and the extra cost due to environmental litigation, the best way for them to respond is through green technology innovation.

In addition, after the establishment of the environmental court, the centralized jurisdiction and centralized management of environmental violation cases provide a great convenience for public environmental litigation. Specialized case management meets the potential judicial needs of pollution victims or non-profit organizations that have nowhere to go when environmental justice is unclear. The clarification of the environmental litigation department and the simplification of the environmental judicial process not only reduces the cost of environmental litigation but also improves the judicial channels

2 https://www.chinacourt.org/article/detail/2022/11/id/7029003.shtml

3 For specific statistics, please refer to the "Trial of China's Environmental Resources (2019)" issued by the Supreme People's Court (https://www.court.gov.cn/zixun-xiangqing-228341.html).

for the public to participate in environmental protection rights, which can make polluting enterprises face greater supervision pressure. Moreover, specialized environmental litigation can also increase the public's expectations for environmental judicial rights protection, and the public is more willing to participate in environmental litigation to safeguard their legitimate rights and interests. In this way, environmental judicial deterrence and public supervision will form a synergy to generate stronger external supervision of polluting firms. As a result, public awareness of environmental needs and supervision will be significantly improved after the establishment of environmental courts. Enterprises will be pressured by public environmental supervision to carry out green technology innovations and achieve environmentally friendly production.

Based on the above analysis, hypotheses are proposed as follows:

Hypotheses 1. The establishment of the environmental court will promote corporate green technology innovation.

4 Methodology and data

4.1 Sample selection and data source

To accurately identify the changes in the green technology innovation capabilities of enterprises before and after the establishment of the environmental court, we select Chinese listed A-shared firms from 2004 to 2019 as the main research sample. The sample data are processed as follows: First, only all listed manufacturing firms from 2004 to 2019 are retained as samples; Second, firms with abnormal financial conditions such as ST and *ST are deleted[4]; Third, firms with a duration of fewer than 5 years are excluded; Fourth, firms with serious lack of financial indicators are deleted.

The data in this paper mainly comes from three parts: The firm green technology innovation data comes from the "China Research Data Service Platform (CNRS)." Specifically, we obtained it by matching the patent classification number information with the "International Patent Green Classification List" issued by the World Intellectual Property Organization (WIPO) in 2010. The data at the firm level comes from the "Cathay Pacific Database (CSMAR)." The city-level data comes from the "China City Statistical Yearbook."

4.2 Variable definition

(1) The dependent variable is firm green technology innovation, which is measured by the number of green patents. Considering the uncertainty and instability in the patent granting process and its vulnerability to bureaucratic factors, patented technologies may begin to have an impact on firms' production during the application process (Tan et al., 2014; Zhou et al., 2021). Therefore, the number of patent applications is more suitable to reflect the green technology innovation level of firms. According to the level of patent technology content, green patents are divided into green invention patents and green utility model patents. In this paper, we choose the total number of green patent applications (*TGpatent*), the applications of green invention patents (*GIpatent*), and green utility model patents (*GUpatent*) as the core explained variables.

(2) The Independent variable is a dummy variable (*Ecourt*) which is used to estimate the policy effect of the environmental courts in DID method. This paper regards the establishment of environmental courts as a quasi-natural experiment in justice reform. If a firm is located in the city that has established an environmental court and the data are from after the policy reform year, *Ecourt* is assigned a value of 1, otherwise, the value is 0. This paper uses the establishment of the prefecture-level city intermediate people's court as the core indicator. On the one hand, since we study green technology innovation at the firm level, the prefecture-level city intermediate people's court has closer contact with local firms in environmental cases than the high people's court, and the supervision effect is more direct. On the other hand, although there are a large number of environmental courts established by grassroots courts, it is difficult to verify the specific time of their establishment. At the same time, due to the fact that the judicial power of environmental protection tribunals in grassroots courts is mostly limited to districts and counties, and there are problems such as legal crises and lack of professionalism, they cannot fully affect the environmental cases of firms in the county or the whole city (Wang and Hang, 2014)

There are two levels of control variables. At the firm level, we control for firm characteristics including firm size (*Size*), firm age (*Age*), capital structure (*Leverage*), profitability (*Roa*), TobinQ (*TobinQ*), and cash holding level (*Cash*), and ownership concentration (*Share*). Considering that the results may be affected by the heterogeneity of cities, we also add the control variables to treat city characteristics including economic development level (*Rgdp*), the level of financial development (*Finance*), solid waste utilization (*Usage*) wastewater discharge (*Sewage*), Sulfur dioxide emissions (*So2*), and industrial soot emissions (*Dust*). The variable definitions and descriptive statistics are shown in Table 1.

4.3 Model specification

In this paper, we employ a DID model to examine the effect of the establishment of environmental courts on firms' green technology innovation. A common setting for the DID model is to add an interaction of policy dummy variables (used to distinguish affected groups) and time dummy (used to identify the time before and after the shock). The interaction term captures the real effect of policy shocks. In this way, we set the DID model as follows:

4 ST refers to the listed firms operating losses for two consecutive years. These firms' financial or other conditions are abnormal and the stock trading has been specially treated; *ST refers to the listed firms operating losses for three consecutive years, and their stocks have been warned of the risk of delisting.

TABLE 1 Variable definition and descriptive statistics.

Variables	Definition	Observations	Mean	Std. Dev.	Min	Max
TGpatent	The natural logarithm of one plus the total number of green patent applications	5,413	1.719091	0.9529987	0	7.062449
GIpatent	The natural logarithm of one plus the number of green invention patent applications	5,413	1.252614	0.9752521	0	6.912743
GUpatent	The natural logarithm of one plus the number of green utility model patent applications	5,413	1.008903	0.8908621	0	6.460217
Ecourt	= 1 if a firm is located in a city that established an environmental court; = 0 otherwise	5,413	0.2033992	0.4025642	0	1
TobinQ	The ratio of firm market value to capital replacement cost	5,413	1.867043	0.9677244	0.876518	6.133729
Cash	The ratio of net cash flow from operating activities to total assets	5,413	0.136287	0.1234328	0.003305	0.584157
Top1	The shareholding ratio of the largest shareholder (%)	5,413	35.90809	15.44961	8.33	76.53
Roa	The ratio of net profit to total assets	5,413	0.0425689	0.052972	−0.156914	0.20897
Debt	The ratio of total liabilities to total assets	5,413	0.3855161	0.1945142	0.0388973	0.8492782
Age	The natural logarithm of the firm age	5,413	15.75371	5.289997	5.75	30.33333
Size	The natural logarithm of the total assets	5,413	22.15076	1.308109	19.95498	25.9992
Rgdp	The natural logarithm of real GDP	5,413	17.52677	1.018729	10.77164	19.32653
Sewage	The natural logarithm of city wastewater discharge	5,413	9.322322	0.875856	5.537334	11.47731
So2	The natural logarithm of city sulfur dioxide emissions	5,413	10.30801	1.36099	6.72022	13.43414
Dust	The natural logarithm of city soot emissions	5,413	9.819983	1.216778	5.659482	15.45815
Usage	The comprehensive utilization rate of solid waste	5,413	4.424293	0.2429924	1.94591	4.964242
Finance	The proportion of financial institution loan balance to GDP at the end of the year	5,413	2.609472	2.793001	0.1467231	180.3978

$$Greeninv_{ict} = \beta_0 + \beta_1 \times Ecourt_{ct} + \beta_2 \times X_{ict} + \beta_3 \times Z_{ct} + \mu_i + \lambda_t + \varepsilon_{ict} \quad (1)$$

Where the subscript i is the firm, c is the city location and t is the year. The dependent variable is the firm green technology innovation ($Greeninv_{ict}$). We use the natural logarithm of one plus the applications for the total number of green patents ($TNpatent$), green invention patents ($GIpatent$), and green utility model patents ($GUpatent$) to measure the firms' green technology innovation. The core independent variable is the dummy ($Ecourt_{ct}$) which indicates whether city c has set up the environmental courts in year t, and its coefficient β_1 represents the effect of the establishment of environmental courts on firms' green technology innovation. X_{it} represents a set of control variables affecting the firms' green technology innovation, Z_{ct} represents a set of control variables at the city level. All the control variables adopt the value lagged one period. μ_i and λ_t are the firm and time fixed effects, respectively. ε_{ict} represents the random disturbance. All the standard errors in our regressions are clustered at the city level to control for the possible intergroup correlations.

5 Empirical results and analysis

5.1 Basic results

The baseline regression results are based on model (1). After controlling city and year fixed effects, the basic estimation results of this paper are presented in Table 2. Columns (1) and (2) take the total number of green patent applications (*TGpatent*) as the independent variable. The coefficients of the policy variable (*Encourt*) are all significantly positive at 1% confidence level whether we add control variables or not, indicating that the establishment of the environmental courts had a positive impact on the green invention patent. As for columns (3) and (4), we take green invention patents (*GIpatent*) as the dependent variable. The coefficients of *Ecourt* are significantly positive whether adding control variables or not, indicating that the establishment of environmental courts can also promote the firm green invention patent applications. Columns (5) and (6) report the regression results for green utility patent applications (*GUpatent*). We find similar results, but the coefficients of *Ecourt* for *GUpatent* are smaller which indicates that environmental courts play a greater role in promoting high-tech green innovation than low-tech green innovation. In sum, our basic results support the *Porter*

TABLE 2 Baseline results.

	Total green technology innovation		High-tech green innovation		Low-tech green innovation	
	TGpatent	*TGpatent*	*Glpatent*	*Glpatent*	*GUpatent*	*GUpatent*
	(1)	(2)	(3)	(4)	(5)	(6)
Ecourt	0.2266***	0.2104***	0.2239***	0.2029***	0.1834***	0.1739***
	(0.054)	(0.051)	(0.063)	(0.057)	(0.039)	(0.049)
TobinQ		0.0025		0.0042		0.0046
		(0.015)		(0.017)		(0.018)
Cash		0.2247		0.3324*		0.1235
		(0.173)		(0.191)		(0.138)
Top1		0.0048		0.0058*		0.0040
		(0.003)		(0.003)		(0.003)
Roa		0.3550		0.1699		0.4621*
		(0.231)		(0.240)		(0.253)
Debt		0.0659		0.0730		−0.0210
		(0.213)		(0.247)		(0.176)
Age		0.1754***		0.1550***		0.1668**
		(0.043)		(0.017)		(0.075)
Size		0.2360***		0.2573***		0.1453***
		(0.049)		(0.049)		(0.044)
Rgdp		0.6346		0.7199		0.3680
		(0.562)		(0.629)		(0.456)
Sewage		0.0906		0.0884		0.1103*
		(0.059)		(0.064)		(0.057)
So2		0.0291		−0.0013		0.0457
		(0.033)		(0.036)		(0.028)
Dust		−0.0070		0.0027		−0.0007
		(0.023)		(0.024)		(0.027)
Usage		0.1887**		0.1682**		0.1289
		(0.080)		(0.075)		(0.089)
Finance		0.0462		0.0561		0.0493
		(0.065)		(0.070)		(0.053)
Constants	0.7782***	−17.7907*	0.2690*	−19.7775*	0.4965***	−11.8421
	(0.159)	(9.280)	(0.147)	(10.312)	(0.180)	(7.724)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.187	0.217	0.198	0.222	0.128	0.145
Observations	6,036	5,413	6,036	5,413	6,036	5,413

Notes: The standard errors are represented in parentheses. All regressions adopt standard errors clustered at the city level. *, **, and *** indicate 10, 5, and 1% significance levels, respectively.

TABLE 3 Parallel trend Test.

	TGpatent	*GIpatent*	*GUpatent*
	(1)	(2)	(3)
Ecourt_5	0.0414	0.0150	0.0106
	(0.105)	(0.119)	(0.073)
Ecourt_4	−0.0102	−0.0591	0.0435
	(0.081)	(0.095)	(0.067)
Ecourt_3	0.0621	0.0248	0.0794
	(0.073)	(0.086)	(0.052)
Ecourt_2	0.0035	−0.0407	0.0254
	(0.051)	(0.060)	(0.058)
Current	0.1763***	0.1678***	0.1056
	(0.065)	(0.061)	(0.066)
Ecourt1	0.1938***	0.1601**	0.2041***
	(0.064)	(0.080)	(0.053)
Ecourt2	0.3069***	0.2419***	0.2913***
	(0.076)	(0.089)	(0.069)
Ecourt3	0.3562***	0.3074***	0.2690***
	(0.063)	(0.073)	(0.066)
Ecourt4	0.4142***	0.3433***	0.3777***
	(0.110)	(0.105)	(0.110)
Ecourt5	0.2658*	0.2377*	0.3098**
	(0.137)	(0.135)	(0.135)
Constant	−17.6350*	−19.6857*	−10.7733
	(9.561)	(10.707)	(7.823)
Control variables	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
R-squared	0.220	0.223	0.147
Observations	5,413	5,413	5,413

Notes: The standard errors are represented in parentheses. All regressions adopt standard errors clustered at the city level. *, **, and *** indicate 10, 5, and 1% significance levels, respectively.

Hypothesis and provided evidence that environmental courts can encourage firms to commit to green transformation and innovation. Moreover, the role of environmental courts in firm green technology innovation is reflected in the promotion of high-tech innovation.

5.2 Parallel trend test and dynamic effects

To ensure the validity of DID estimation, the parallel trend assumption must be satisfied which requires that there is no significant difference in the green technology innovation between the treatment group and control group firms before the establishment of environmental courts when controlling for other factors.

With regard to this assumption, referring to Jacobson et al. (1993), we divide the variable *Ecourt* into a set of interaction terms between environmental courts status and dummy variables relative to the setting year of environmental courts. The specific estimation equation is as follows:

$$Greeninv_{ict} = \beta_0 + \sum_{n=-5, n\neq 0}^{5} \theta_n \times Ecourt_{c,t+n} + \beta_2 \times X_{ict} + \beta_3 \times Z_{ct} + \mu_i + \lambda_t + \varepsilon_{ict} \quad (2)$$

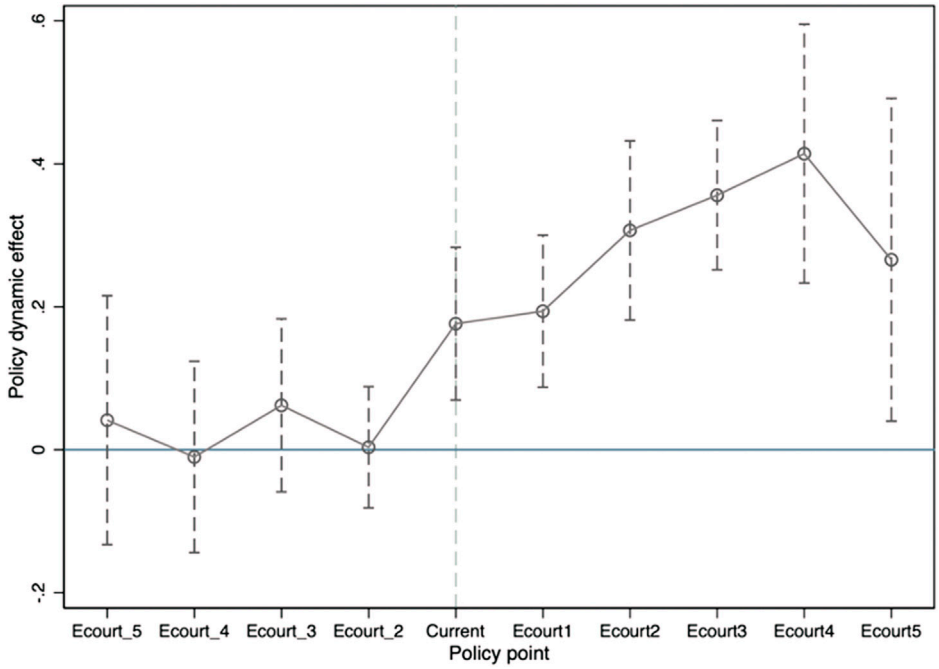

FIGURE 1
Parallel trend Test for *TGpatent*.

Where $Ecourt_{c,t+n}$ represents the nth year relative to the setting year of environmental courts. $n < 0$ indicates the nth year before the setting year. $n > 0$ indicates the nth year after the setting year of environmental courts, and $n = 0$ represents the setting year of the environmental courts. Since our sample period is from 2004 to 2019, we set $n = -5$ if $n < -5$ and $n = 5$ if $n > 5$ as the two endpoints to make the best use of data information and reduce estimation errors. Furthermore, to avoid collinearity in the regression, we take $n = 0$ as the base year.

Table 3 presents the regression results of the parallel trend test. Figure 1 shows the parallel trend charts *TGpatent*, and the charts for *GIpatent* and *GUpatent* are shown in Supplementary Figures A1, A2 in Supplementary Appendix A1. We observe that before the environmental courts' establishment ($n \leq 1$), the value of coefficients θ_n are near to 0 and insignificant, suggesting that before the establishment of environmental courts, there was no significant difference in the firms' green technology innovation between the treatment group and the control group. After setting up the environmental courts ($n > 0$), it can be found that both the magnitude and significance of θ_n have significantly increased. The above results demonstrate that the parallel trend assumption has been satisfied and our empirical analysis is valid.

Moreover, we also find that the duration of the positive dynamic effect of environmental courts lasts for approximately 4 years, indicating that the positive effect of environmental justice reform is sustainable.

5.3 Robustness checks

5.3.1 PSM-DID

Ideally, in our regression, the treatment and control group firms are identical in all aspects except whether one firm is located in the city with an environmental court or not. In reality, this case hardly exists and there is often a problem of sample self-selection bias. So, to alleviate the possible self-selection bias, we combine the propensity score matching (PSM) and DID method to re-examine the baseline regressions. Specifically, we first select individual firm characteristics including firm size (*Size*), firm age (*Age*), capital structure (*Leverage*), profitability (*Roa*), TobinQ (*TobinQ*), cash holding level (*Cash*), and ownership concentration (*Share*) as matching variables. Then we use the 1: 1 nearest neighbor matching to conduct PSM. Finally, we run the DID regressions on the new PSM samples.

Table 4 shows the regression results of the PSM-DID estimation. And the results of the sample data balancing test after the matching is shown in Supplementary Table A1 in the Supplementary Appendix A1. The estimation results are similar to the baseline results. The coefficient of the policy variable (*Ecourt*) is significantly positive, indicating that the establishment of environmental courts can promote firms' green technology innovation in the pilot area. Overall, although the coefficients of our interest under PSM-DID are larger than that in the baseline results, it is still positively significant which proves that our baseline results above are robust.

5.3.2 Tobit and negative binomial regression

Although the overall distribution of the patent data is spread over a wide range of positive values, it is also relatively concentrated at zero values. Given this distribution of the dependent variable, it may be difficult to obtain a consistent estimate through ordinary least squares (OLS) (Davidson and MacKinnon, 2004). In such cases, the Tobit model is a more suitable method to solve the problem of such a censored dependent variable. In addition, we also performed regressions with a zero-inflated negative binomial

TABLE 4 PSM-DID estimation.

	Total green technology innovation		High-tech green technology innovation		Low-tech green technology innovation	
	TGpatent	TGpatent	GIpatent	GIpatent	GUpatent	GUpatent
	(1)	(2)	(3)	(4)	(5)	(6)
Ecourt	0.2259***	0.2245***	0.2253***	0.2164***	0.1942***	0.1909***
	(0.055)	(0.052)	(0.064)	(0.057)	(0.042)	(0.051)
Constants	0.7182***	−18.9117**	0.1884	−24.0837**	0.4331**	−11.0716*
	(0.180)	(9.137)	(0.149)	(9.824)	(0.210)	(6.610)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.188	0.213	0.199	0.220	0.126	0.138
Observations	5,189	4,708	5,189	4,708	5,189	4,708

Notes: The standard errors are represented in parentheses. All regressions adopt standard errors clustered at the city level. *, **, and *** indicate 10, 5, and 1% significance levels, respectively.

TABLE 5 Results with Tobit and ZINB models.

	Tobit regression			ZINB regression		
	TGpatent	*GIpatent*	*GUpatent*	*TGpatent*	*GIpatent*	*GUpatent*
	(1)	(2)	(3)	(4)	(5)	(6)
Ecourt	6.3233***	10.8637***	6.5294***	0.2622***	0.3125***	0.2651***
	(1.880)	(1.557)	(0.756)	(0.040)	(0.047)	(0.052)
Constant	−284.236***	−251.171***	−76.921***	0.3108	−0.7539	1.0883
	(22.800)	(19.023)	(9.320)	(0.805)	(0.959)	(1.033)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,413	5,413	5,413	4,920	4,856	4,620

Note: The standard errors are represented in parentheses. ***, **, and * represent different significance levels, indicating $p < 0.01$, $p < 0.05$, and $p < 0.1$, respectively.

regression model (ZINB) for the robust test. Table 5 reports the regression results. The coefficients of the core independent variable (*Ecourt*) are positively significant and consistent with the baseline regression results. The above regression results once again prove the robustness of the baseline results, indicating that the establishment of environmental courts significantly promotes the green technology innovation of Chinese firms.

5.3.3 Placebo test

To further that our results are not biased due to random chance, we perform a bootstrapping placebo test following Cai et al. (2016) and Ma et al. (2021) by randomly assigning environmental court setting status to cities. Specifically, we randomly assign the environmental courts setting status to different years during our research period while assuming that the total number of environmental courts in our research is fixed, and then. For instance, 8 cities set up the environmental courts in 2014, so we randomly select 1 year from our sample period as the setting year and construct a *false* treatment dummy, i.e., $Ecourt_{ct}^{false}$. Then, we run the baseline DID regressions based on the pseudo-sample and repeat this randomization process 500 times. If real policies do play a role, then the newly constructed variables of interest should have no impact on green technology innovation. The distribution of the false coefficients and their associated *p*-values for *TGpatent* are shown in Figure 2. Supplementary Figures A3, A4 show the results for *GIpatent* and *GUpatent* in Supplementary Appendix A1. The distributions center around zero and most of the *p*-values are larger than 0.1. At the same time, our true estimators (red lines denote the true value of coefficients in Table 2) are clear outliers. These results indicate that our baseline results are not severely biased due to any random chance which verifies the robustness of our analysis.

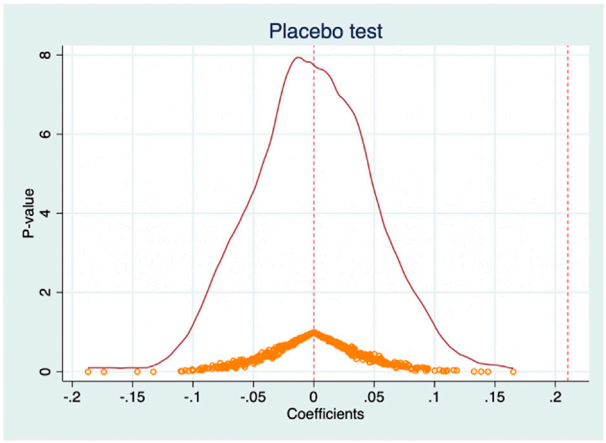

FIGURE 2
Placebo test for *TGpatent*.

6 Influencing mechanism analysis

According to the theoretical hypothesis above, On the one hand, the establishment of environmental courts can improve the judicial fairness and efficiency of environmental cases and increase the risk of environmental litigation faced by enterprises, thus enabling enterprises to carry out green technology innovation. On the other hand, the establishment of environmental courts has also promoted the environmental awareness of the public (Edwards, 2013). With the improvement of the public's awareness of environmental protection, enterprises will also be subject to the corresponding pressure of environmental supervision from the public, so as to carry out green technology innovation. As a result, we empirically test the potential mechanisms behind the green technology innovation effect brought by the environmental court from two aspects of judicial pressure and external supervision pressure.

Referring to the method proposed by Baron and Kenny (1986), we construct mediating effect models to test the underlying influence mechanism above. Specific steps are as follows. First, the intermediary variables of environmental penalty cases are used as the dependent variables, and the establishment of environmental courts is used as an independent variable to run the regression model (3). Then, we take corporate green technology innovation as the dependent variable and the intermediary variable as the independent variable to run the regression model (4). Finally, we include green technology innovation, the intermediary variables, and policy variables in the regression model (5) to estimate the policy effect of environmental courts. The mediating effect exists only if coefficients α_1; δ_1 and θ_2 are significant and θ_1 becomes smaller than β_1 in the model (1) or less significant. And then, the theoretical mechanism described above can be established through the mediating effect test.

$$Mid_{ct} = \alpha_0 + \alpha_1 \times Ecourt_{ct} + \varphi \times X_{ict} + \gamma \times Z_{ct} + \mu_i + \lambda_t + \varepsilon_{ict} \quad (3)$$

$$Greeninv_{ict} = \delta_0 + \delta_1 \times Mid_{ct} + \varphi \times X_{ict} + \gamma \times Z_{ct} + \mu_i + \lambda_t + \varepsilon_{ict} \quad (4)$$

$$Greeninv_{ict} = \theta_0 + \theta_1 \times Ecourt_{ct} + \theta_2 \times Mid_{ct} + \varphi \times X_{ict} + \gamma \times Z_{ct} + \mu_i + \lambda_t + \varepsilon_{ict} \quad (5)$$

In models (3)–(5), *Mid* are the intermediary variables that represent the environmental litigation pressure and the external supervision pressure. We take the number of regional environmental penalty cases (*Punishcase*) to proxy the environmental litigation pressure (Zhang et al., 2019). The data of regional environmental penalty cases are manually collected by the authors from specialized environmental litigation websites[5]. For external supervision pressure, we measured it in two ways. First, we use the logarithm of the number of environmental complaint letters received by regional government departments (*Emletter*). The related data are collected from the "China's Environmental Yearbook." Then, we take Baidu Index on environmental pollution to proxy for the level of external supervision pressure (*Baidu*). In China, Baidu's search engine has a market share of more than 80%. Baidu Index reflects the attention of Internet users to a certain field when using Baidu's search engine. This pressure of public attention has a huge impact on corporate decision-making. Referring to Kahn and Kotchen (2011) and Zheng et al. (2012), we use Python to crawl the Baidu index of each city with the keyword "environmental pollution."

The regression results of the mediating effect tests are shown in Table 6. Columns (1)–(2) show the mechanism test of environmental litigation pressure. The regression coefficient of *Ecourt* in column (1) is 0.1468 and statistically significant, suggesting that environmental courts raise litigation pressure on firms. In column (2), both the *Ecourt* and *Punishcase* variables are included in the regression model. The coefficient of *Ecourt* is 0.2516, which is significant and smaller than that in the baseline model when the intermediate variable is not included, proving the existence of the mediating effect of environmental litigation pressure and indicating that environmental courts increase corporate green technology innovation by imposing environmental litigation pressure on firms.

Another potential channel through which environmental courts can influence green technology innovation is external supervision pressure. Columns (3)–(6) in Table 6 show the results of this mediating effect. Similarly, the coefficients of *Ecourt* in columns (3) and (5) are significantly positive, which shows that environmental courts promote public awareness of environmental protection. Columns (4) and (6) incorporate both the *Ecourt* and intermediate variables into the regression model. The regression coefficients of *Ecourt* are positively significant and relatively smaller than the result in the baseline model which proves the mediating effect of external supervision pressure and indicates that environmental courts promote green technology innovation by imposing external supervision pressure on firms.

Combining the above empirical results, it can be concluded that the environmental courts have improved the efficiency of environmental

5 The data on environmental penalty cases is obtained from the China Judgments Online website, where verdict documents are publicly available (http://wenshu.court.gov.cn).

TABLE 6 The results of the mechanism analysis.

	Environmental litigation pressure		External supervision pressure			
	Punishcase	*TGpatent*	*Emletter*	*TGpatent*	*Baidu*	*TGpatent*
	(1)	(2)	(3)	(4)	(5)	(6)
Ecourt	0.1468**	0.1561***	0.1368*	0.0605***	0.0420**	0.1258***
	(0.060)	(0.046)	(0.078)	(0.026)	(0.017)	(0.029)
Punishcase		0.0449***				
		(0.011)				
Emletter				0.0189**		
				(0.010)		
Baidu						0.0120***
						(0.004)
Constant	−15.8705	−12.7339	7.1466***	−4.2494***	8.9786	−20.6920
	(34.051)	(14.722)	(1.369)	(1.629)	(6.060)	(13.163)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.11	0.082	0.025	0.059	0.27	0.131
Observations	3,931	3,931	2066	2066	4,287	4,287

Notes: The standard errors are represented in parentheses. All regressions adopt standard errors clustered at the city level. *, **, and *** indicate 10, 5, and 1% significance levels, respectively.

TABLE 7 The level of local law environment.

	Low level of law environment			High level of law environment		
	TGpatent	*Glpatent*	*GUpatent*	*TGpatent*	*Glpatent*	*GUpatent*
	(1)	(2)	(3)	(4)	(5)	(6)
Ecourt	0.1779*	0.2166*	0.0786	0.2338***	0.1936***	0.2348***
	(0.106)	(0.114)	(0.100)	(0.062)	(0.069)	(0.064)
Constant	−13.8132	−7.5947	−10.9177	−17.8420	−28.3599**	−4.5994
	(9.771)	(11.318)	(8.397)	(11.967)	(12.479)	(7.984)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.220	0.215	0.186	0.230	0.241	0.141
Observations	1879	1879	1879	3,534	3,534	3,534

Notes: The standard errors are represented in parentheses. All regressions adopt standard errors clustered at the city level. *, **, and *** indicate 10, 5, and 1% significance levels, respectively.

justice and the enforcement of punishment so that firms will face higher litigation risks and illegal costs. In addition, the environmental courts meet the public's environmental rights protection needs, thereby enhancing public awareness of environmental protection. Therefore, firms will invest more in green technology innovation activities when facing the pressure of environmental litigation and external supervision brought by the environmental court.

7 Further analysis

7.1 Local law environment

The improvement of the judicial system provides a guarantee for the validity and enforcement of the law, and a sound legal system environment is the basis for the effectiveness of the judicial system.

TABLE 8 Local government intervention.

	Low level of intervention			High level of intervention		
	TGpatent	*Glpatent*	*GUpatent*	*TGpatent*	*Glpatent*	*GUpatent*
	(1)	(2)	(3)	(4)	(5)	(6)
Ecourt	0.1304	0.1275	0.0918	0.2428***	0.2233***	0.2114***
	(0.092)	(0.094)	(0.098)	(0.059)	(0.073)	(0.052)
Constant	−9.2361	−9.9778	−14.7269	−26.0206**	−28.5109**	−12.3949
	(12.810)	(11.879)	(10.530)	(11.632)	(14.229)	(10.134)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.262	0.268	0.169	0.215	0.219	0.146
Observations	1,454	1,454	1,454	3,959	3,959	3,959

Notes: The standard errors are represented in parentheses. All regressions adopt standard errors clustered at the city level. *, **, and *** indicate 10, 5, and 1% significance levels, respectively.

Therefore, to examine the effectiveness of the environmental justice system, we must consider the differences between local environmental legislation and legal systems. We selected the number of local environmental laws and regulations promulgated by each region as the proxy for the local law environment, the relevant data can be obtained in the "China Environmental Statistics Yearbook". Simultaneously, based on the median number of local environmental laws and regulations, we divided the sample into low and high law environment. The specific regression results are shown in Table 7. Columns (1)–(3) report the coefficients of *Ecourt* on green technology innovation in the subsample of low level of law environment and the coefficients are positive and significant at 10% level while the coefficient of *GUpatent* is insignificant. Columns (4)–(6) show a significant positive impact of environmental courts on firm green technology innovation in the subsample of the high level of law environment. The results indicate that when the firm is located in a region with a better law environment, the environmental court can better play its role and combine with local laws and regulations to promote the green technology innovation ability of the firm.

7.2 Local government intervention

In China, the constraint of environmental regulation on environmental pollution may be weakened by the existence of local government intervention. According to Li and Zhou (2005), local government officials often pursue the desired economic outcomes under the pressure of political promotion. Then in this case, local governments may ignore the pollution behavior of enterprises for the sake of local economic performance, or even interfere with judicial justice in order to safeguard relevant interests.

Therefore, if the establishment of environmental courts can bring external cost pressure to enterprises and encourage relevant pollution firms to carry out green technology innovation, a question worth exploring is how government intervention affects our precious results? To answer this, we divided the samples into two groups, high and low levels of government intervention according to the marketization index, and performed regressions respectively. The regression results are shown in Table 8. We find that the coefficients of *Ecourt* in columns (4)–(6) are significantly positive at the 1% confidence level, while the coefficients of *Ecourt* in columns (1)–(3) are insignificant, indicating that the role of environmental courts in promoting firms' green technology innovation is more pronounced in areas with severer government intervention. This result also means that the strengthening of the legal system brought about by the environmental court helps to weaken the government's protection of local firms and maintain legal authority.

7.3 Differences in firms' ownership

In China, the differences between SOEs and non-SOEs can not be ignored in terms of financial support and government connections (Piotroski and Wong, 2012). Specifically, Due to the nature of their relationship with local governments, SOEs are more vulnerable to government favoritism, especially when facing certain policy shocks compared with non-SOEs. Therefore, there are differences in performance and behavioral manifestations among enterprises with different ownership (Gadenne et al., 2009). In this subsection, we further examine the effect of environmental courts on a firm's green technology innovation considering ownership structures. Table 9 presents the group regression results based on ownership. Columns (1)–(3) takes SOEs as the research samples. The coefficients of *Ecourt* are insignificant. While in columns (4)–(6) which take non-SOEs as the samples, the coefficients of *Ecourt* are positively significant at 1% confidence level. The results show that the promoting effect of environmental court on firms' green technology innovation is more pronounced in SOEs rather than non-SOEs.

TABLE 9 Differences in firms' Ownership.

	State-owned			Non-state-owned		
	TGpatent	*Glpatent*	*GUpatent*	*TGpatent*	*Glpatent*	*GUpatent*
	(1)	(2)	(3)	(4)	(5)	(6)
Ecourt	0.2869***	0.2738***	0.2249***	0.1250	0.1024	0.1115
	(0.057)	(0.062)	(0.059)	(0.088)	(0.093)	(0.091)
Constant	−17.4550	−23.5103*	−14.1225	−22.8169**	−21.5804*	−15.3314
	(13.511)	(13.274)	(11.975)	(10.617)	(11.791)	(9.853)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.155	0.157	0.138	0.281	0.276	0.179
Observations	2,993	2,993	2,993	2,266	2,266	2,266

Notes: The standard errors are represented in parentheses. All regressions adopt standard errors clustered at the city level. *, **, and *** indicate 10, 5, and 1% significance levels, respectively.

8 Conclusion

As an important reform of environmental protection undertaking in China, the establishment of the environmental courts not only improve the environmental judicial system but also provides an important institutional guarantee for the coordinated development of the environment and economy. There's great practical significance to explore the economic effect of environmental court on firm green transformation. Taking Chinese A-share listed firms from 2003 to 2019 as our research samples, we adopt the DID method to investigate how the establishment of environmental courts affects corporate green transformation from the perspective of green technology innovation. Our study provides empirical evidence proving that the establishment of environmental courts significantly promotes green technology innovation among enterprises which also supports the Porter hypothesis, and compared with low-tech green innovation, environmental courts play a greater role in promoting high-tech green innovation. In addition, the potential mechanisms behind the results are that the more effective judicial enforcement and better public awareness of environmental supervision brought by the environmental court have increased the cost of illegality and external supervision pressure for firms, which will enable firms to carry out green technology innovation. Furthermore, the impact of environmental courts on corporate green technology innovation also depends on the nature of the enterprises and the regions in which the enterprises are located. That is, the positive impact of the environmental court is more pronounced in SOEs and firms located in regions where local protectionism is more serious. At the same time, in regions with a more perfect environmental legal system, environmental courts have more significant promoting effects on green technology innovation.

Our findings have clarified the impact of environmental courts on corporate green technology innovation and its potential influencing mechanism and provided enlightenment and guidance to policymakers to further promote the green transformation of enterprises. First, the results show that environmental courts can promote green technology innovations and the effect is closely related to judicial efficiency and the law environment. Policymakers should further improve various systems in environmental courts and combine judicial enforcement to formulate effective environmental regulations and policies. Second, considering that public participation is an indispensable part of environmental governance, policymakers should let the public know about environmental courts through publicity, announcements, *etc.*, so as to give full play to the role of environmental courts to increase public participation in environmental protection.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found here: https://www.gtarsc.com.

Author contributions

Conceptualization, ST; methodology, MH and ZF; software, ST and DZ; validation, ST; formal analysis, ST and MH; resources, ZF and DZ; data curation, ST and ZF; writing-original draft preparation, ST; writing-review and revision on original draft, ST and MH; supervision, ZF and DZ. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fenvs.2023.1090853/full#supplementary-material

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