

# Public Data Openness and Corporate Green Technology Innovation

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**How to cite this paper:** Zhang, J. (2026). Public Data Openness and Corporate Green Technology Innovation. *Economics and Public Policy*, 1(3), 40-46. ISSN Print: 3104-4387; ISSN Online: 3104-4395. <https://doi.org/10.63313/EPP.9019>  
**Published: 2026-03-13**

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## Abstract

With the rapid development of the digital economy, public data has become an important strategic resource. The openness of government data can improve information transparency and promote the efficient use of data resources. This paper aims to examine the impact of public data openness on corporate green technology innovation. Using panel data of Chinese A-share listed companies from 2007 to 2023, this study constructs an empirical model to analyze the relationship between public data openness and corporate green innovation. The results show that public data openness significantly promotes corporate green technology innovation. The findings indicate that improving the level of public data openness can provide a favorable environment for enterprises to conduct green innovation and support sustainable economic development.

## Keywords

Public Data Openness; Green Technology Innovation; Digital Economy; Corporate Innovation

## 1. Introduction

With the rapid development of the digital economy, data has gradually become an important factor of production and an important strategic resource for economic development[1]. Governments around the world have increasingly recognized the value of data resources and have promoted the construction of open data platforms. Public data generated by government departments during the process of providing public services contains abundant information related to economic activities and industrial development. By opening these data resources to the public, governments can improve information transparency and promote the efficient use of data resources [2][3]. At the same time, green technology innovation has become an important way for enterprises to achieve sustainable development. Existing studies show that green innovation plays an important role in improving corporate environmental performance and promoting sustainable economic growth [4][5].

Against this background, exploring the relationship between public data openness and corporate green technology innovation has important practical significance. Using panel data of Chinese A-share listed companies, this paper examines the impact of public data openness on corporate green technology innovation and provides empirical evidence on the role of data openness in promoting sustainable development.

## 2. Methodology

### 2.1. Sample and Data

This paper uses panel data of Chinese A-share listed companies from 2007 to 2023 as the research sample. Financial firms are excluded because their financial structures differ significantly from other industries[6]. The financial data of listed companies are obtained from the CSMAR database. Data on public data openness are mainly collected from the China Local Government Data Openness Report and official government websites. After removing firms with missing values, the final sample consists of a large number of firm-year observations. This sample selection method is widely used in studies on corporate innovation and environmental performance [7][8].

### 2.2. Variable Definition

The dependent variable in this paper is corporate green technology innovation (Green\_Inno), which is measured by the number of green patent applications filed by firms. Green patents are widely used to measure corporate green innovation in existing studies [5]. The key explanatory variable is public data openness (Open\_Data), which indicates whether a city has established a public data platform in a given year. The construction of open data platforms reflects the level of government data openness and information transparency. Following previous studies, several firm-level variables are included as control variables, including firm size (Size), leverage (Lev), profitability (ROA), and firm age (Age), which may influence corporate innovation activities [9]. See Table 1 for details.

**Table 1.** Definition of main variables

variable symbol	variable definition
Green_Inno	The number of green invention patents granted by enterprises, plus one to take the logarithm
Open_Data	The public data open platform of the city where the enterprise is located is assigned 1, otherwise it is assigned 0.
Size	The total assets of the enterprise at the end of the period, take logarithm
Age	Listing year of the enterprise, take the logarithm
Lev	The proportion of total liabilities to total assets
Cash	( Monetary Fund + Transactional Financial Assets ) / Total Assets
Top	Shareholding ratio of the largest shareholder
Tobin	Tobin Q value

Growth	( Total operating income of the current year-total operating income of the previous year ) / Total operating income of the previous year
Board	The number of the board of directors at the end of the year, take the logarithm
Roa	Net profit / total assets * 100 %
Mbratio	Total Assets / Market Value

### 2.3. Model Specification

To examine the impact of public data openness on corporate green technology innovation, this paper constructs the following regression model:

$$Green\_Inno_{it} = \alpha + \beta Open\_Data_{it} + \gamma Controls_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

where Green\_Inno represents corporate green innovation, Open\_Data represents public data openness, and Controls represents control variables.  $\mu_i$  and  $\lambda_t$  denote firm fixed effects and year fixed effects, respectively. The coefficient  $\beta$  captures the effect of public data openness on corporate green innovation. This empirical framework is widely used in studies on innovation and policy evaluation [10].

### 3. Empirical Results

Table 2 reports the baseline regression results examining the impact of public data openness on corporate green technology innovation. Column (1) presents the regression results without adding control variables. The coefficient of public data openness is positive and statistically significant, indicating that public data openness promotes corporate green technology innovation[11]. Columns (2)–(4) further include firm-level control variables. The results show that the coefficient of public data openness remains significantly positive. This suggests that public data openness improves the availability of information resources and reduces information asymmetry, thereby encouraging firms to engage in green technological innovation activities[12][13]. This finding is consistent with previous studies emphasizing the role of information transparency and digital infrastructure in promoting corporate innovation[14][15]. Overall, the empirical results provide evidence that public data openness has a significant positive effect on corporate green technology innovation. The results are shown in table 2.

**Table 2.** Benchmark regression results

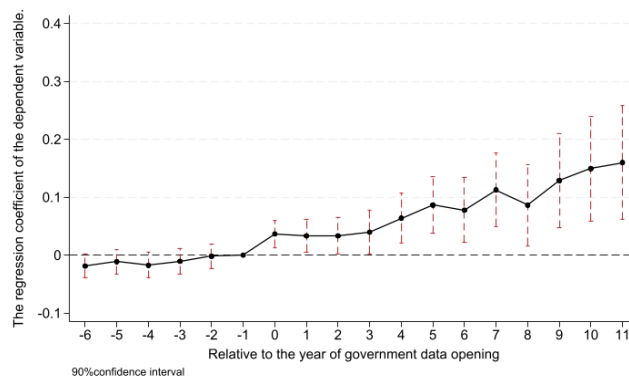
variable	(1)	(2)	(3)	(4)
	Green_Inno	Green_Inno	Green_Inno	Green_Inno
Open_Data	0.080*** (4.256)	0.036*** (3.157)	0.036*** (3.186)	0.034*** (3.072)
Cash			-0.116*** (-4.228)	-0.100*** (-3.468)
Growth			-0.015*** (-3.434)	-0.023*** (-5.231)
Tobin			0.005 (1.519)	0.015*** (4.277)
Lev			0.098***	-0.026

			(3.308)	(-0.869)
Roa			0.189***	-0.009
			(4.680)	(-0.211)
Mbratio			0.200***	0.065*
			(6.366)	(1.941)
Size				0.127***
				(10.682)
Age				-0.024*
				(-1.852)
Top				-0.000
				(-0.469)
Board				-0.033
				(-0.954)
_cons	0.227***	0.248***	0.093***	-2.450***
	(21.696)	(45.230)	(3.185)	(-9.747)
Firm	NO	YES	YES	YES
Year	YES	YES	YES	YES
N	45 042	45 042	45 042	45 042
Adj. R2	0.039	0.566	0.568	0.575

## 4. Robustness Test

### 4.1. Parallel Trend Test

To verify the validity of the difference-in-differences estimation, this paper conducts a parallel trend test. The key assumption of the DID approach is that the treatment group and the control group follow similar trends before the policy implementation. Therefore, before the implementation of public data openness, there should be no significant difference in the trend of corporate green technology innovation between cities that later established public data platforms and those that did not[16]. Following the event-study approach, this paper estimates a dynamic DID model by introducing a series of time indicators that measure the relative distance between the sample year and the year of public data platform implementation[17]. To avoid multicollinearity, the period immediately before the implementation of public data openness is set as the reference period. The estimation results show that the coefficients of the pre-policy periods are not statistically significant, indicating that there is no systematic difference in the trends of green innovation between the treatment group and the control group before the policy implementation. After the implementation of public data openness, the estimated coefficients become significantly positive and show an increasing trend over time, suggesting that public data openness has a persistent promoting effect on corporate green technology innovation. These results support the validity of the parallel trend assumption[18] (See Figure 1.) .



**Figure 1.** Parallel Trend Test Effect Chart

#### 4.2. Measurement method of substitution variables

In order to alleviate the problem of measurement error, this paper replaces the measurement method of the explained variable and re-regression. For the explained variables, this paper selects the number of corporate green invention patent applications ( Green \_ apply ) as the proxy variable for corporate green technology innovation. Green \_ apply reflects the amount of investment in green innovation of enterprises, which can verify the impact of public data opening on green technology innovation of enterprises from different angles, and avoid the possible deviation caused by a single proxy variable [ 122 ]. The regression results of columns ( 1 ) - ( 4 ) in Table 4-2 show that the estimated coefficients of Open variables remain positive and significant at a statistical level of 5 %, whether under different model settings that include control variables or do not include control variables, which confirms that public data openness is robust to the promotion of green technology innovation of enterprises. The results show that public data openness can effectively promote green technology innovation of enterprises under different model settings, and its impact is robust under different proxy variables. Therefore, through the use of alternative variables, this paper further verifies the important role of public data openness in promoting green technology innovation of enterprises. At the same time, the results also show that the benchmark regression conclusion of this paper is not significantly affected by the change of the measurement method of the explained variable, and the model estimation has good stability and reliability. It can be seen that the positive role of public data opening in promoting green technology innovation of enterprises has strong robustness. The results are shown in table 3.

**Table 3.** Measurement of substitution variables

variable	(1)	(2)	(3)	(4)
	Green_apply	Green_apply	Green_apply	Green_apply
Open_Data	0.1270***	0.0378**	0.0367**	0.0318**
	(4.2245)	(2.2768)	(2.2303)	(2.0042)
Cash			-0.0848**	-0.0226
			(-2.2272)	(-0.5775)

Growth			-0.0030	-0.0202***
			(-0.4114)	(-2.9307)
Tobin			0.0085	0.0282***
			(1.5386)	(5.2095)
Lev			0.2568***	0.0698**
			(7.9349)	(2.2300)
Roa			0.5405***	0.1657***
			(8.8805)	(2.6996)
Mbratio			0.3382***	0.0618
			(7.5119)	(1.2855)
Size				0.2630***
				(14.4299)
Age				-0.0588***
				(-3.3249)
Top				-0.0014
				(-1.4493)
Board				0.0174
				(0.3551)
_cons	0.4990***	0.5434***	0.2267***	-5.2618***
	(28.0695)	(65.5273)	(5.5621)	(-13.2844)
N	47429	47429	47429	47429
Adj. R2	0.0454	0.6523	0.6559	0.6677

## 5. Conclusion

This paper examines the impact of public data openness on corporate green technology innovation using panel data of Chinese A-share listed companies. By employing a difference-in-differences model, this study analyzes the policy effect of public data platform construction on firms' green innovation activities.

The empirical results show that public data openness significantly promotes corporate green technology innovation. The baseline regression results indicate that the establishment of public data platforms provides firms with more accessible information resources and improves information transparency, thereby encouraging enterprises to engage in green technological innovation. In addition, the results of the parallel trend test and robustness tests further confirm the reliability of the empirical findings.

These findings provide important policy implications. Governments should continue to promote the construction of public data platforms and improve the openness and accessibility of public data resources. By enhancing information transparency and reducing information asymmetry, public data openness can help stimulate firms' innovation activities and promote green and sustainable development.

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