ISSN: 2710-0588

Can Government Procurement Incentivize Green Technology Innovation?

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Abstract

Green innovation is an important starting point for implementing the new development concept and a powerful driving force for building a new development pattern. This paper empirically examines the impact of government procurement on enterprises' green technology innovation by constructing a two-way fixed effect model based on the data of government procurement orders and enterprises' patent data from 2015 to 2020. It is found that government procurement can significantly promote enterprises' green technology innovation level. Under the fair competition review system, compared with government procurement in other places, local government procurement can significantly promote enterprises' green technology innovation. Further differentiating the heterogeneity of enterprises, the results show that the green technology innovation effect of non-state-owned, small-scale and high financing constraint enterprises is stronger. The research conclusions of this paper further provide a new path for the policy development of government procurement and have great reference value to help promote the technological innovation of enterprises.

Keywords

Government Procurement; Green Technology Innovation; Enterprise Innovation; Innovation Policy.

1. Introduction

In recent years, the CPC Central Committee and The State Council have made a series of major decisions and plans on accelerating the green transformation of the development mode and doing a good job in green technology innovation. The State Council issued the Guiding Opinions on Accelerating the Establishment of a Sound Economic System for Green, Low-carbon and Circular Development, which takes "Building a market-oriented green technology innovation system" as one of its key tasks, and calls for encouraging the research and development of green and low-carbon technologies and accelerating the transformation of scientific and technological achievements. Accelerating green technology innovation will mobilize the transformation of development mode from resource-driven to innovation-driven, and realize the transformation from simple scale expansion to high-quality structural upgrading, and the transformation from quantity to quality to achieve "incremental quality improvement". This is of certain positive significance from all angles. Innovation in green technology is an important driving force for green and low-carbon development, an important guarantee for the modernization of harmonious coexistence between man and nature, and the realization of a beautiful China. It is also the key to high-quality development.

The balance between economic development and the ecological environment needs to be solved, and the government and all walks of life have paid close attention to the problem of pollution prevention and the improvement of environmental quality. Economic development,

ISSN: 2710-0588

ecological environment issues also need to pay attention to, in order to balance the two, the Party and the state have formulated and promulgated a series of environmental policies and regulations, environmental regulation means are also divided into command environmental regulation and market environmental regulation, to accelerate the green transformation of China's manufacturing industry, government procurement policy is the government in the way of market regulation to support enterprises to carry out green technology innovation Explore. As an important market-based environmental policy tool, does China's government procurement policy promote corporate green technology innovation?

This paper uses text analysis to extract 2015-2020 government procurement order data and enterprise patent data, matches the data of listed companies with government procurement contracts, and empirically tests the relationship between government procurement and enterprise green technology innovation by constructing a two-way fixed effect model. The research finds that government procurement significantly promotes the level of green technology innovation of enterprises. Based on the fair competition review system, compared with government procurement in other places, local government procurement can significantly promote enterprises' green technology innovation. To further distinguish the heterogeneity of enterprises, this innovation incentive effect is stronger in the green technology innovation effect of non-state-owned, small-scale and high financing constraint enterprises. The conclusions of this paper provide theoretical support and empirical evidence for optimizing green financial policies.

The marginal contributions of this paper are as follows: First, this paper explores the internal causal relationship between government procurement policy, a market-based environmental policy tool, and enterprise technological innovation; Second, the data source used in this paper is government procurement contracts, and the text analysis method is used to identify government procurement policies, which provides accurate basic conditions for empirical accurate evaluation; Thirdly, this paper verifies that government procurement policies positively promote enterprises' green technology innovation, and provides a new perspective for objectively evaluating the development of government procurement policies in the green direction.

2. Theoretical Analysis and Hypothesis

Generally speaking, government innovation support policies can be divided into supply side and demand side. On the supply side, the government supports enterprise innovation with innovation subsidies, research and development tax relief and intellectual property protection and other policies; On the demand side, the government supports enterprise innovation mainly through innovative procurement and trade control (Sun Wei and Ye Chusheng, 2023). In developed countries, policymakers have paid more and more attention to demand-side innovation support policies with innovative procurement as the core (Dai et al.,2021), Aschhoff and Sofka(2009), Guerzoni and Raiteri(2015), and found that in terms of promoting enterprise innovation, Government innovation procurement is a more effective policy tool than innovation subsidies. Jiang Aihua, Fei Kun Jie (2021) and Jiang Aihua et al. (2022) proposed that government procurement policies could positively promote enterprise innovation, optimize the business environment and promote the relationship between the two, while senior executives' tenure experience inhibited the relationship between the two.

According to the environmental Kuznets curve, the level of international economic development and the degree of environmental pollution show an inverted "U" shape. When a country's economic development level reaches a certain level, that is, when it reaches a certain critical point, with the increase of per capita income level, the degree of environmental pollution will gradually slow down and the level of environmental quality will be improved

ISSN: 2710-0588

accordingly. Based on the current environmental development situation, the government needs to introduce a series of environmental regulation policies and promote environmental governance with the help of green technological innovation. Government procurement is results-oriented in guiding the effect of green innovation. Although the existing literature discusses the mechanism of government procurement affecting enterprises' green technology innovation, there are few systematic theoretical frameworks. Perhaps due to the availability of data, few literatures have conducted empirical tests on the relationship between the two. Based on this empirical study, this paper explores the relationship between government procurement policy and the effect of enterprise green technology innovation.

The core goal of fair competition review system is to reduce unreasonable restrictions on competition by policies and measures. The original design intention of this policy is consistent with the essential connotation of the principle of competitive neutrality (Yan Ziqiao and Li Wanli, 2023). Under the mechanism of combining ex ante and ex post supervision, it is preliminarily believed that compared with government procurement in other places, local government procurement plays a greater role in promoting technological innovation of enterprises.

The implementation of appropriate "local priority" in innovation procurement may have a positive innovation incentive effect, which is particularly obvious in the regions and industries in the early stage of development, and the above view is also in line with the "infant industry protection theory" of development economics.

Based on the above discussion, this paper proposes:

Hypothesis H1: Government procurement can significantly promote enterprises' green technology innovation.

Hypothesis H2: Under the fair competition review system, compared with government procurement in other places, local government procurement can significantly promote enterprises' green technology innovation.

3. Research Design

3.1. Model Setting

With reference to (Sun Wei, 2023), this paper constructs a two-way fixed effect model to empirically test the impact of government procurement on enterprises' green technology innovation. The specific model is as follows:

$$Innovation_{i,t} = \alpha + \beta \Pr ocurement_{i,t} + \gamma Controls_{i,t} + \lambda_i + \theta_t + \varepsilon_{i,t}$$

Where, is the green innovation of the explained variable enterprise, indicating the technological innovation level of enterprise i in year t. This paper uses $Innovation_{i,t}$ two different indicators to measure the number of green patent applications (GTI) of enterprise i in year t and the proportion of green patent applications in the total number of patent applications (PGTI). $\Pr ocurement_{i,t}$ As the core explanatory variable of this paper and the dummy variable of government procurement, when firm i obtains government procurement orders in year t, it is assigned a value of 1, otherwise it is 0. $Controls_{i,t}$ Is the other control variable, is the residual term. $\varepsilon_{i,t}$ In addition, firm fixed effect and year fixed effect are also controlled in this paper, and the regression standard error is clustered at firm level. λ_i θ_t

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3.2. Data Source and Processing

This paper adopts python crawler method to obtain data related to government procurement policies. As the "Regulations on the Implementation of the Government Procurement Law of the People's Republic of China" implemented on March 1, 2015, "the purchaser shall, within 2 working days from the date of signing the government procurement contract, announce the government procurement contract on the media designated by the financial department of the people's government at or above the provincial level", Therefore, the time span of this paper takes 2015 as the starting point. Using the relevant contracts in the system of "Government procurement Contract Announcement Inquiry" published by the government procurement network, the website reveals the name of the contract, the date of signing, the specific procurement object, the region, the supplier, the name of the purchaser, etc. The related financial data of listed companies come from the National Tai 'an database, and the enterprise code of listed companies is used as the intermediary to build the matching data of "government procurement contracts - listed enterprises".

In this paper, listed companies are selected as research samples, with a time span from 2015 to 2020. Specifically, the economic financial data related to this paper comes from the Guotai 'an Database (CSMAR), the enterprise patent data comes from the State Intellectual Property Administration and the Betan Patent retrieval system, and the other financial data comes from the Wind database. In order to ensure the rationality and validity of the sample data, this paper makes the following routine processing of the original data: (1) Enterprises that have been continuously losing money by ST, *ST or PT during the sample period are excluded; (2) The samples whose core variables are seriously missing (3) the financial enterprises are seriously missing (4) the samples whose important indicators are seriously missing. In this paper, all the continuous variables were downtailed by 1%, and finally obtained the effective sample data of 3,253 listed companies, a total of 12,303 observation samples of panel data. The data analysis and processing are completed by stata processing.

3.3. Variable Definition

Explained variable: enterprise green technology innovation. From the perspective of innovation output, that is, the number of patent applications, this paper measures enterprises' green technology innovation from two perspectives. The first part is measured by the number of green patent applications (GTI) of enterprises this year. In the second part of the robustness test, this paper uses the proportion of the number of green patent applications in the total number of patent applications (PGTI) of the enterprise this year to measure.

Core explanatory variable:government procurement. As the core explanatory variable of this paper, it is the virtual variable of government procurement. When enterprise i obtains government procurement orders in year t, it is assigned a value of 1, otherwise it is 0. In the robustness test part, in order to measure the intensity of government procurement, this paper uses the natural logarithm of the contract amount of government procurement order obtained by the enterprise plus one.

Other control variables:This paper controls a series of control variables that may affect the level of green innovation of listed companies, including: Enterprise Size (Size), asset-liability ratio (Lev), cash flow level (Cfo), growth (Grow), return on assets (Roa), Market power (Market), capital intensity (Density), ownership concentration (Top), board size (BSize), board independence (Indep), Enterprise ownership (Soe).

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Table 1. Variable definitions

Variable names			Definition
Explained variable	Enterprise green technology innovation	GTI	Number of green patent applications filed by enterprises this year
		PGTI	Number of green patents filed by companies during the year
Explanatory variables	Government procurement	Procurement	Dummy variable, which is assigned a value of 1 if the firm received a government purchase order that year, and 0 if not
Control variable	Business size	Size	The natural logarithm of the total assets of the business
	Asset-liability ratio	Lev	Ratio of total liabilities to total assets
	Cash flow level	Cfo	Net cash flow from operating activities as a percentage of total assets
	Growth	Grow	Revenue growth
	Return on assets	Roa	Net profit to total assets
	Market power	Market	ln (Sales revenue/operating cost +1)
	Capital intensity	Density	ln (total fixed assets/number of employees)
	Concentration of ownership	Top	Share of top 10 shareholders
	Board size	BSize	Number of board members in the business
	Proportion of independent directors	Indep	Percentage of independent directors on the board
	Ownership of enterprises	Soe	Dumb variable, SOE/non-SOE

3.4. Descriptive Statistics

Table 2 reports the descriptive statistical results of the full sample of the main research variables of the paper. The average value of the sample green technology innovation of enterprises is 0.409, that is, the number of green patent applications of the sample listed companies is about 1.9 per year.

Table 2. Descriptive statistics of the full sample

	(1)	(2)	(3)	(4)	(5)
Variable name	Sample size	Mean	Standard deviation	Minimum	Maximum
GTI	12303	0.409	0.824	0	3.871
Procurement	12303	0.144	0.352	0	1
Size	12303	22.32	1.274	19.97	26.21
Lev	12303	0.422	0.199	0.0636	0.887
Cfo	12303	0.0506	0.0681	0.158	0.247
Grow	12303	0.132	0.274	0.347	1.678
Roa	12303	0.0312	0.0745	0.339	0.191
Market	12303	0.925	0.222	0.69	1.96
Density	12303	12.64	1.175	9.168	15.76
Top	12303	0.338	0.144	0.0952	0.737
BSize	12303	8.451	1.612	5	14
Indep	12303	0.377	0.0532	0.333	0.571
Soe	12303	0.339	0.473	0	1

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4. Empirical Research

4.1. Benchmark Regression Results

As shown in Table 3 below, the benchmark regression results about the explained variables being enterprise green technology innovation (GTI) and the core explanatory variable government Procurement (Procurement) were reported. No control variables were added to column (1), and control variables were added to column (2). On the basis of adding control variables to column (3) and further controlling the annual and firm fixed effects, the regression coefficients are significantly positive at the level of 1%, preliminarily verifying hypothesis 1: government procurement can significantly promote enterprise green technology innovation. According to the third column regression results, after controlling the control variables and the annual firm fixed effect, the number of green patent applications of enterprises with government purchase orders increased significantly by 7.62% this year. Hypothesis 1 in this paper has been further verified.

Table 3. Baseline regression results

	GTI		
	(1)	(2)	(3)
Procurement	0.4110 * * *	0.3369 * * *	0.0762 * * *
	(-8.7259)	(8.0405)	(-2.9605)
Size		0.1259 * * *	0.0167
		(7.6160)	(-0.8027)
Lev		0.0518	-0.0814
		(0.7115)	(-1.2539)
Cfo		0.4105 * * *	-0.0363
		(2.8712)	(-0.4311)
Grow		0.0211	0.0213
		(0.7474)	(-1.0654)
Roa		0.7840 * * *	0.0292
		(6.1304)	(-0.3695)
Market		-0.3154 * * *	-0.0413
		(-6.9571)	(-0.8402)
Density		-0.0291 * * *	-0.0126
		(-2.6131)	(-1.2546)
Top		(0.0178)	-0.1798
		(-0.1762)	(-1.3481)
BSize		0.0174	0.0007
		(1.5014)	(-0.0752)
Indep		0.3740	0.2246
		(1.1894)	(-1.0147)
Soe		-0.0642 * *	-0.046
		(2.0294)	(-1.0476)
Annual fixed effect	No	No	Yes
Corporate fixed effect	No	No	Yes
Observations	12303	12303	11925
R-squared	0.031	0.082	0.783
Description: *** p<0.01, ** p<0.05, * p<0.1; Robust t statistic in parentheses			

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4.2. Robustness Test

4.2.1. Change Variables

Different measurement methods of indicators usually produce different results, so this paper will change the definition of explained variables in the robustness test part, that is, the number of green patent applications of an enterprise in the total number of patent applications of the enterprise in the year (PGTI). Table 4 below reports the regression coefficients of government procurement and enterprise green innovation. (1) - (3) are no control variable, add control variable, add control variable and further control the fixed effect of the annual enterprise, respectively. The regression coefficients are significantly positive at the level of 1%, and the regression results are consistent with the benchmark results, which further verifies hypothesis.

Table 4. Change variables

	PGTI		
	(1)	(2)	(3)
Procurement	0.0367***	0.0383***	0.0182***
	-6.5649	-6.6279	-3.5042
Size		0.0015	0.0042
		-0.8319	-0.7823
Lev		0.0253**	-0.0214
		-2.0721	(-1.3588)
Cfo		0.0223	0.0166
		-0.9354	-0.707
Grow		0.0214***	0.0172***
		-3.3428	-2.6692
Roa		0.0376	-0.0363
		-1.6137	(-1.5038)
Market		-0.0364***	-0.0109
		(-5.3341)	(-0.8025)
Density		0.0049**	-0.0051*
		-2.3685	(-1.7978)
Top		-0.0171	-0.0304
		(-1.0950)	(-0.7961)
BSize		0.0011	-0.0018
		-0.7324	(-0.8220)
Indep		0.0122	-0.0099
		-0.2683	(-0.1884)
Soe		-0.0016	-0.004
		(-0.3249)	(-0.3599)
Annual fixed effect	No	No	Yes
Corporate fixed effect	No	No	Yes
Observations	12303	12303	11925
R-squared	0.008	0.017	0.569
Description: *** p<0.01, ** p<0.05, * p<0.1; Robust t statistic in parentheses			

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4.2.2. Add more Fixed Effects

With the advance of time, the industry and urban environment of listed companies are changing, which leads to certain differences in the time series of variables. In order to control the influence of missing variables, columns (1) - (4) of Table add the fixed effect of year*industry, year*city and city*industry respectively. The regression results of the table show that the regression coefficient of the core explanatory variable of this paper, enterprise green innovation GTI, is still very significant, which indicates that the basic conclusion of this paper is still robust after controlling the differences of the regions and industries over time.

Table 5. Adds more fixed effects

	GTI			
	(1)	(2)	(3)	(4)
Procurement	0.0367***	0.0383***	0.0182***	0.0367***
	-6.5649	-6.6279	-3.5042	-6.5649
Control variables	Yes	Yes	Yes	Yes
Annual FE	No	No	Yes	No
Enterprise FE	Yes	Yes	Yes	Yes
Year * Industry FE	Yes	No	No	Yes
Year * City FE	No	Yes	No	Yes
City * Industry FE	No	No	Yes	Yes
Constant	0.0597	0.2678	0.0289	0.4006
	(0.1369)	(0.5676)	(0.0474)	(0.6707)
Observations	11964	11186	11740	10892
R-squared	0.786	0.804	0.82	0.84

Description: *** p<0.01, ** p<0.05, * p<0.1; Robust t statistic in parentheses.

4.2.3. Mechanical Tests

Article 2 of the Implementation Rules for the Fair Competition Review System (State Municipal Regulatory Anti-Ridge Regulation (2021) No. 2) stipulates: "Administrative organs and organizations authorized by laws and regulations with the function of managing public affairs, when formulating market access and exit, industrial development, investment promotion, bidding and tendering, government procurement, business code of conduct, qualification standards and other rules involving the economic activities of market entities, normative documents, other policy documents and specific policy measures in the form of" one case, one discussion ", They shall conduct a fair competition review." Compared with other systems, the fair competition review system of pre-examination and post-supervision combined system has a more prominent impact, the system strictly requires pre-inspection, effectively stop the proliferation of local protection and hidden barriers, specifically related to government procurement related policies and measures and documents tender matters before release to strictly perform the review procedure. This measure is conducive to breaking down the hidden barriers to bidding. Therefore, this paper preliminarily believes that local government procurement has a greater promoting effect on enterprise technological innovation than that of government procurement in different places.

This paper classifies the government procurement orders of the research object into the fields to which the government procurement orders belong, and divides the government procurement orders obtained by listed companies into local government procurement orders (LocalPur) and NonLocalPur government procurement orders (NonLocalPur), which are defined as virtual variables by the empirical model processing, specifically: If the listed

ISSN: 2710-0588

company obtains government purchase orders within the city/province where it is located, that is, local government purchase orders, then LocalPur is assigned 1; otherwise, LocalPur is assigned 0; If the listed company only gets government orders outside its city/province i.e. off-site government purchase orders, then NonLocalPur is assigned 1, otherwise NonLocalPur is assigned 0. Subdivision to the regional level, this paper classifies the regions according to the city and province levels, and the empirical results are shown in the following table:

Table 6. Mechanism test: Fair competition review system

	GTI	
	(1)	(2)
	City level	Province level
LocalPur	0.2048 * *	0.1913 * * *
	-2.5448	-3.1416
NonLocalPur	0.1565 * * *	0.1510 * *
	-2.6719	-2.0053
Control variables	Yes	Yes
Annual fixed effect	Yes	Yes
Corporate fixation	Yes	Yes
Constant	-0.3209	-0.3263
	(-0.5368)	(-0.5458)
Observations	12303	12303
R-squared	0.796	0.796

Description: *** p<0.01, ** p<0.05, * p<0.1; Robust t statistic in parentheses.

Table 6 regression reports the corresponding regression results. It specifically shows the impact of local government purchase orders and off-site purchase orders on the green technology innovation behavior of listed companies. The results are divided into four columns, among which, column (1) and (2) are subdivided to the city level. According to the government procurement, whether the government subject and the listed company that has obtained the government procurement order belong to the same city is determined to be local procurement or off-site procurement; if the region belongs to the same city, it is determined to be local procurement; if it does not belong to the same city, it is determined to be off-site procurement; Similarly, column (3) (4) is subdivided to the provincial and municipal level, according to the government procurement whether the government subject and the listed company that obtains the government procurement order belong to the same province to determine the local procurement or off-site procurement. The results of the two different classification methods show the same. The regression results show that no matter local government procurement or remote government procurement, government procurement can significantly promote enterprises' green technology innovation, and the regression results are positive and significant, which supports the hypothesis H1 in this paper. By comparing the regression coefficients of local government procurement and remote government procurement, the regression coefficients of local government procurement are greater than those of remote government procurement. Through the comparison of coefficient sizes, hypothesis H2 is further verified.

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4.3. Heterogeneity Analysis

4.3.1. Heterogeneity of Enterprise Ownership

According to the classification of enterprise ownership in this paper, compared with state-owned enterprises, non-state-owned enterprises with fewer resources usually find it difficult to carry out innovation activities and more difficult to win government procurement orders. Based on this, non-state-owned enterprises have greater incentive for green innovation effect of government procurement, and maintain or increase the number of government procurement orders by constantly improving their green innovation level. In Table 7, columns (1) - (2) report the relationship between government procurement and enterprise green innovation after distinguishing between state-owned enterprises and non-state-owned enterprises. The regression results show that compared with state-owned enterprises, the regression coefficient of the sample of non-state-owned enterprises is significant at 1% level and the regression coefficient is larger. The results show that under the premise of distinguishing enterprise ownership, The green innovation effect of government procurement in non-state-owned enterprises is more significant.

4.3.2. Heterogeneity of Firm Size

Based on firm size heterogeneity, this paper classifies firms as large and small based on median annual asset size. The Administrative Measures on Government Procurement to Promote the Development of Small and Medium-sized Enterprises, issued by the Ministry of Finance and the Ministry of Industry and Information Technology in 2020, make it clear that in principle all small procurement projects are reserved for small and medium-sized enterprises. Small and medium-sized enterprises are an important foundation for building a modern economic system and achieving high-quality economic development. Officials from the Ministry of Finance and the Ministry of Industry and Information Technology said the two departments attach great importance to supporting the use of government procurement policies to support the development of small and medium-sized enterprises. Therefore, it is reasonable to assume that government procurement will provide more innovation support to small-scale enterprises. In Table 7, columns (3) - (4) report the differentiation between large-scale enterprises and small-scale enterprises, and explore the green innovation effect of government procurement on enterprises under the premise of considering the heterogeneity of enterprise size. The regression results show that the regression coefficient of both large-scale enterprises and small-scale enterprises is positive and significant, but the regression coefficient of small-scale enterprises is larger and more significant than that of large-scale enterprises. It indicates the existence of firm size heterogeneity under the effect of government procurement innovation.

4.3.3. Heterogeneity of Firm Financing Constraints

Based on the heterogeneity of corporate financing constraints, this paper measures the level of financing constraints faced by enterprises according to the WW index, and divides them into enterprises with high financing constraints and enterprises with low financing constraints according to the annual industry median. Financing constraints affect the R&D technical ability of enterprises, and sufficient funding research drives enterprises with high financing constraints to carry out high-quality innovation activities. It is expected that government procurement activities can more promote green innovation activities of enterprises with high financing constraints. In Table 7, columns (5) to (6) report the differentiation between enterprises with high financing constraints and enterprises with low financing constraints, and explore the green innovation effect of government procurement on enterprises under the premise of considering the heterogeneity of corporate financing constraints. The regression results show that compared with enterprises with low financing constraints, enterprises with high financing constraints have more significant regression coefficient, that is, greater

ISSN: 2710-0588

innovation effect. The conclusion proves that the promotion effect of government procurement on corporate green innovation is mainly reflected in enterprises with high financing constraints.

Table 7. Heterogeneity test

	(1)	(2)	(3)	(4)	(5)	(6)
	State-owned enterprises	Non-state-owned enterprises	Large enterprises	Small Businesses	Enterprises with high financing constraints	Enterprises with low financing constraints
	GTI					
Pur	0.0181	0.1347***	0.0718*	0.1158***	0.0949**	0.0514
	(-0.5124)	(-3.6594)	(-1.8156)	(-2.7046)	(-2.568)	(-1.0354)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Annual fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Corporate fixation	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.2153	-0.5982	-0.2652	0.8489	0.7675	-0.9015
	(-0.2038)	(-1.0594)	(-0.2935)	-1.4475	-1.306	(-0.8556)
Observations	3966	7941	4736	4521	5606	3262
R-squared	0.832	0.749	0.793	0.812	0.804	0.814

Description: *** p<0.01, ** p<0.05, * p<0.1; Robust t statistic in parentheses.

5. Conclusion and Suggestions

Green technology innovation is becoming an important emerging field in the new round of global industrial revolution and scientific and technological competition. With the establishment and improvement of China's green, low-carbon and circular development economic system, green technology innovation has increasingly become an important driving force for green development, and an important support for fighting pollution prevention and control, promoting ecological civilization construction, and promoting high-quality development. In the context of building a market-oriented green technology innovation system, this paper obtains relevant government procurement data by means of python crawling and manual organizing, and achieves one-to-one matching with the specific data of listed companies. Empirical results show that government procurement policies can significantly promote enterprises' green technology innovation. Further, based on the fair competition review system, whether at the city level or the province level, local government procurement has a stronger green innovation promotion effect than remote government procurement. Finally, based on the heterogeneity at the firm level, it is found that non-state-owned, small-scale and high financing constraint enterprises are more sensitive to green innovation and have stronger promoting effect. Based on the above conclusions, this paper puts forward relevant specific suggestions. The construction of a market-oriented green technology innovation system requires the concerted efforts of local governments, enterprises, financial institutions and other forces to promote the formation of a new pattern of green technology innovation in which various innovation entities are bursting with vitality and innovation efficiency is continuously improved. To provide strong scientific and technological support for accelerating the green transformation of development mode and promoting high-quality development.

To continue to promote the expansion of the scale of government procurement, this paper concludes that government procurement policies can significantly promote the green

ISSN: 2710-0588

technology innovation of enterprises. Based on this, this paper suggests: First, the government should vigorously promote the innovative design and implementation of such policies in the development practice of formulating and implementing relevant policies, so as to further mobilize the activity of small and medium-sized enterprises and carry out innovative activities. Second, pay attention to the heterogeneity of enterprises, and enhance the pertinence of government procurement policies to different types of enterprises. We should attach importance to the innovation potential of non-state-owned and small and medium-sized enterprises, guide large enterprises to open up their application scenarios, share production factors, build common technology platforms, and encourage integrated innovation among middle and downstream, large and small enterprises along the industrial chain. Third, we will enhance green financial services such as government procurement financing guarantees. The government should guide the green financial services of enterprises through the introduction of policies, and further support the green technology innovation activities of enterprises with high financing constraints. Through rational allocation of financial resources to guide funds to environmentally friendly enterprises, alleviate the financing pressure of enterprises' green innovation activities.

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