

Research on the Impact of Government Investment on Enterprise R&D Innovation—Based on the Mediation Effect Model

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Abstract: Although government procurement is used as a demand-side innovation policy tool in many countries, how government procurement affects corporate technological innovation is still controversial, and its mechanism has not been empirically tested. The research in this paper finds that, from the perspective of enterprises, government procurement should be measured from the scale of government procurement contracts obtained by enterprises and the degree of support from government purchasers. The scale of procurement contracts obtained by enterprises and the degree of support obtained by enterprises from purchasers have an impact on the input and output of enterprise technological innovation. It has a significant positive role in promoting, and technological innovation investment plays an intermediary role in it.

Keywords: Government Investment; R&D Innovation; Intermediary Effect

1. Introduction

In recent years, academia and government departments have generally recognized the market failure of innovation and the insufficiency of supply-side innovation policies. They have turned to focus on and research demand-side innovation policies and their impact in terms of innovation policy orientation^[1], and policy makers have begun to tend to stimulate technological innovation in the private sector based on demand. Especially in the public domain, the most important measure is to play the incentive effect of government procurement on innovation. This is reflected in many policy measures promulgated by the United States, the European Union, Australia and other countries. For example, the European Commission's EU 2020 strategy puts public procurement as the main policy tool to achieve smart sustainable growth and is building an "innovation alliance" which plays an important role in Energy Saving Europe.

Contrary to the government's enthusiasm for innovation-oriented government procurement, the academic community has always been cautiously optimistic about the innovative incentives of government procurement. Although government procurement is regarded as one of the important policy tools of demand-side innovation policy, it is also pointed out that the promotion effect of government procurement on innovation still lacks case and empirical support^[1-2]. Some scholars even think that some government procurement plans may be intentional. It unintentionally promotes enterprise innovation, but the extent to which government procurement promotes innovation is still unknown^[3]. The conclusions of some domestic and foreign studies indicate that government procurement has a positive effect on technological innovation^[4], and some studies have found that government procurement has no effect on technological

innovation, especially in my country^[5-6]. On the other hand, current empirical studies are mostly based on industry and regional levels, and there are few micro-level studies. How companies participating in government procurement affects their own technological innovation, and its mechanism of action have not yet been thoroughly analyzed. In view of this, from the perspective of enterprises, this article will focus on the core issue of “Does government procurement promote the technological innovation of Chinese enterprises?”, take an empirical approach to study the impact of government procurement on enterprise technological innovation, and examine the effect of government procurement on enterprise technological innovation by comprehensive and in-depth analysis.

2. Literature review

The technological innovation driving force of enterprises mainly includes technology promotion and market pulling. The early market pulling power mainly discusses the pulling effect of consumer market demand. However, since the 1980s, with the increasingly prominent effect from government demand in technological change, public sector needs and public policy’s dominance of technological progress has attracted attention, and government procurement is a concentrated expression of public sector needs.

Government procurement has multiple goals such as saving costs, promoting fairness, preventing corruption, etc. The establishment of the goal of promoting innovation has always been controversial^[7]. Scholars and policy makers have recognized that government procurement will promote changes in corporate behavior through demand and have the effect of influencing innovation. For example, Geroski analyzed multiple innovations from public procurement in the computer and semiconductor industries. It is pointed out that by adopting high standards, clearly describing needs, encouraging competition, etc., promoting procurement has become an effective tool for stimulating innovation. Sun Xiaohua and Yang Bin studied the impact of government procurement in 9 EU countries on technological innovation, and found that government procurement can promote technological innovation^[8].

3. Data and variables

Based on previous research results, this research mainly uses the number of patent applications, the frequency of new product launches, and sales volume to reflect the two technological innovation output levels. Technological innovation investment mainly includes human resource investment, capital investment, technology investment and equipment investment, etc., which are measured by 4 items. This study analyzes government procurement from the two perspectives of the scale of procurement contracts and the degree of related support. It is measured by four items including the amount of government procurement contracts signed in the past three years, the number of procurements, and the proportion of company sales^[9]. The degree of government procurement support that companies receive includes providing clear procurement demand information and obtaining corresponding procurement policy preferences or preferential procurement rights^[10]. Financial support, information support and technical support are also essential. Drawing on Uyarra and others, forming 8 measurement government procurement offices supported items. Control variables include enterprise size, R&D human resources, R&D investment intensity, external R&D funding, and new product development capabilities. This study uses questionnaire surveys to collect data. Questionnaire surveys were conducted in Hangzhou, Jiaxing, Shaoxing, Ningbo and other places in Zhejiang Province^[11].

4. Empirical analysis

4.1 Government investment and technological innovation investment

This paper uses technological innovation input as the explained variable, government procurement contract scale and degree of support as the explanatory variable, and adds control variables such as enterprise scale, enterprise R&D human resources, R&D investment intensity, external R&D funding ratio and new product development capabilities to

establish a model. Using the regression equation for analysis, the results are shown in Table 1.

Variable Type	Variable Name	Explained variable: investment in technological innovation	
		Model 1	Model 2
Government Procurement	Purchase contract size		0.469***
	Purchaser's degree of support		0.699***
Control variable	Enterprise size	0.279**	0.105*
	R & D human resources	-0.247**	-0.023
	R&D investment intensity	0.002	0.075
	Public R&D funding	0.175*	-0.030
	New product development function	0.066	-0.040
Constant term	constant	-1.126*	-0.290
Regression effect	R^2	0.22	0.754
	\bar{R}^2	0.182	0.738
	F	5.907***	45.214***

Table 1. The impact of government procurement on technological innovation investment.

The regression results in Table 1 show that, among the control variables, the size of the enterprise has a significant positive effect on the investment in technological innovation for the completion of government procurement, and the influence coefficients are 0.279 ($p < 0.01$) and 0.105 ($p < 0.05$), respectively. This shows that the larger the scale of an enterprise, the more technological innovation in purchasing. Other control variables did not have a significant impact on technological innovation investment. For Chinese companies, the size of the company will affect the technological level of the company and the company's R&D investment decisions. Small companies are often restricted in terms of R&D investment and financing, technological capability accumulation, etc., and they are unable to carry out innovative activities. This verifies the "Schumpeter hypothesis" to a certain extent.

The regression coefficients of the scale of government procurement contracts and the degree of government procurement's support to technological innovation input are 0.469 and 0.699 respectively ($p < 0.00$, it means that the larger the scale of the government procurement contract a company receives, and the greater the support given by the government procurement party to the company, the enterprises invest more in technological innovation in purchasing). This shows that the large purchase contracts and strong support from purchasers have increased the willingness of enterprises to innovate, and stimulated the investment in enterprise innovation activities to better achieve transaction goals.

4.2 Government procurement and technological innovation output

The following takes technological innovation output as a dependent variable, government procurement and technological innovation input as independent variables, adding control variables such as enterprise scale, enterprise R&D human resources, R&D investment intensity, external R&D funding ratio and new product development capabilities to establish a model step by step. Using the regression equation, this paper analyses the impact of government procurement on the technological innovation output of enterprises. Table 2 shows the results of stepwise regression analysis. From Table 2, it can be found that new product development capabilities have a significant positive effect on technological innovation output with an impact coefficient of 0.136 ($p < 0.05$). This shows that control variables such as the size of the enterprise, the intensity of R&D investment and the public R&D funding received by the enterprise do not have a significant impact on the output of technological innovation. The regression coefficients of the scale of the government procurement contract obtained by the enterprise and the degree of support from the purchaser on the technological innovation output of the enterprise are respectively 0.565 ($p < 0.001$) and 0.502 ($p < 0.001$), which means the scale of the government procurement contract and the procurement support obtained by the enterprise significantly promoted the technological innovation output of enterprises. Government purchasers provide enterprises with more innovation support from the demand-side perspective, thereby significantly promoting the technological

innovation output of enterprises.

Variable Type	Variable Name	Explained variable: Technological innovation output		
		Model 3	Model 4	Model 5
Explanatory variables	Purchase contract size		0.565***	0.450***
	Purchaser's degree of support		0.502***	0.332**
	Technological innovation investment			0.243*
Control variable	Enterprise size	0.183**	0.015	-0.011
	R & D human resources	-0.179	0.099	0.105
	R&D investment intensity	-0.131	-0.077	-0.095
	Public R&D funding	0.296*	0.090	0.098
	New product development function	0.196*	0.136*	0.145*
Constant term	constant	-1.310*	-0.655*	-0.585*
Regression effect	R^2	0.256	0.631	0.645
	\bar{R}^2	0.221	0.606	0.617
	F	7.235***	25.144***	23.193***

Table 2. The impact of government investment on enterprise R&D output.

4.3 The mediating effect of technological innovation input

This study uses the sequential inspection method proposed by Baron and Kenny and Wen Zhonglin to examine the intermediary role of technological innovation input in the relationship between government procurement and technological innovation output in 2021. In Table 2, Model 4 shows that government procurement is driving enterprise technological innovation. Model 2 shows that the scale of government procurement contracts and the received support have a significant positive effect on technological innovation investment (see Table 2). Model 5 (see Table 2) shows that when technological innovation inputs are introduced, the regression coefficients of government procurement contract size and support received on technological innovation output are 0.450 ($p < 0.001$) and 0.332 ($p < 0.01$) respectively. The regression coefficient of technological innovation input to technological innovation output is 0.243 ($p < 0.05$). It shows that the scale of government procurement contracts, the degree of support from government procurement parties, and corporate investment are driving technological innovation. Therefore, technological innovation input plays a significant intermediary role between the scale and support of government procurement contracts and technological innovation output. The intermediary effects account for 19.26% and 32.30% of the total effects, respectively, and the intermediary effects are all positive. This shows that the higher the scale of government procurement contracts and the support of the purchaser, the greater the investment in technological innovation of the enterprise, the more it can increase the output of technological innovation.

5. Conclusions

This study verifies the role played by technological innovation input between government procurement and technological innovation output, and explains the mechanism of government procurement on technological innovation. Most of the research on government procurement has not studied government procurement from the perspective of enterprises, especially from the perspective of suppliers, and failed to examine the impact mechanism of government procurement on technological innovation from the microscopic perspective. This research shows that technological innovation investment plays a significant intermediary role in it. As a pre-variable, government procurement is conducive to promoting technological innovation input, which will have an impact on technological innovation output. Therefore, in order to promote the incentive role of government procurement in technological innovation, the implementation of government procurement in our country should focus on designing a reasonable contract scale and

not let the contract be too scattered; government procurement suppliers should be guided and encouraged to invest in technological innovation based on government procurement, research and development; the interaction between buyers and sellers during the implementation of government procurement should be strengthened to provide more support for the technological innovation of government procurement suppliers.

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