Empirical Analysis of Government Procurement Promoting Independent Innovation

- Empirical Analysis Based on Data of Hunan Province

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Abstract: Based on the government procurement data of Hunan Province from 2011 to 2015, this paper uses DEA method to measure the efficiency of independent innovation, and uses linear regression to analyze the impact of government procurement on the efficiency of independent innovation. Government procurement plays an active role in promoting independent innovation of enterprises. The total amount of government procurement has a positive impact on the efficiency of enterprises' independent innovation.

1. Introduction

In today's society with rapid economic development, independent innovation plays an important role in economic development. As an important part of government financial expenditure, government procurement plays a macro-control role. How to make good use of this control means has become an important issue faced by governments.

In recent years, research articles based on government procurement and promoting independent innovation of enterprises have emerged in endlessly. For example, Wang Qijiang pointed out that government procurement has played a very powerful role in promoting the independent innovation activities of high-tech industries, and mainly manifested in reducing market risk, expanding the production scale of products, improving the operating efficiency of enterprises and accelerating the innovation and development of enterprises [1]. According to Hu Changsheng's research, the overall implementation of government procurement strategy in China in recent years is good, but there are also some problems, which hinder the independent innovation of enterprises [2]. Zhang Kai and Hao Xiaoyan believe that government procurement plays a very important role in stimulating and promoting enterprises' independent innovation activities. First, government procurement ensures the stability of internal production and development of enterprises, which can help enterprises effectively overcome the difficulties encountered in the process of independent innovation in terms of funds, manpower and other aspects; second, government procurement provides important support from the external market environment by buying a large number of enterprises' independent innovation products [3].

Based on the data of government procurement in Hunan Province from 2011 to 2015, this paper

uses DEA analysis method to measure the efficiency of independent innovation. Through linear regression analysis, this paper empirically analyses and compares the influence factors of government procurement on the efficiency of independent innovation, so as to provide corresponding theoretical support and practical guidance for government procurement in China, so as to speed up the construction of an innovative country and strengthen the support of science and technology. A modern power.

2. The Theoretical Basis of Government Procurement Promoting Independent Innovation

The theoretical basis of government intervention in promoting independent innovation of SMEs by government procurement should be explored from two aspects: government procurement intervention and government intervention demand of SMEs [4].

On the one hand, from the perspective of government procurement intervention, with the increasing scale and scope of government procurement, government procurement has become a powerful demand force in market activities. However, it should be pointed out that the demander of this powerful force shoulders both the mission of innovation and the restraint of short-sighted market behavior [5]. In reality, although the scale and scope of government procurement in our country are larger, it is still smaller than that in developed countries, which also provides more possibilities for government procurement to play a policy role in promoting the development of small and medium-sized enterprises.

On the other hand, from the point of view of government intervention demand of SMEs, although SMEs in China have developed rapidly and contributed more and more to economic growth, there is still a big gap compared with large enterprises at home and abroad. To solve these problems, enterprises need to make efforts on their own, and the state should provide relevant policies to support and intervene [6].

3. The Development Process and Achievements of Hunan Purchasing

3.1 The Development Process of Hunan Purchasing

3.1.1 The expanding Scale of Government Procurement

According to the data, in recent years, the scale of government procurement in Hunan Province has shown a trend of sustained and rapid growth [7]. The actual purchasing scale in 2016 is 11.2 times larger than that in 2005. In 2005, the actual purchasing scale was 7.84 billion yuan, which accounted for 6.7% of the provincial financial expenditure and 1.4% of the provincial GNP. By 2016, the actual purchasing scale was 88.0 billion yuan, accounting for 10.2% of the total fiscal expenditure and 2.56% of the total GDP of the province.

3.1.2 The reasonable Constitution of Government Procurement

In 2005, the actual purchasing amount of Hunan Province was 7.84 billion yuan, of which 49.1%, 44.4% and 6.5% were purchasing items of goods, engineering and services respectively. By 2016, the actual purchasing amount of the province was 88.0 billion yuan, and the scale of the three purchasing projects accounted for 38.9%, 53.1% and 8.0% of the total scale, respectively. This also shows that the composition of Hunan's government procurement is gradually transforming from physical assets procurement to large-scale engineering and service assets procurement, and its government procurement structure tends to be more reasonable.

3.2 Main Results

3.2.1 Development of the Number of Innovative Enterprises

In recent years, private investment in Hunan Province has continued to be active. In 2016, for example, 79,000 newly registered scientific and technological enterprises in Hunan Province increased by 72.1% and registered capital increased by 54.3% to 166.105 billion yuan.

3.2.2 Development of Patent Number

In terms of the number of enterprise patents, in 2015, the output value of Hunan enterprises' new products totaled 66.089 billion yuan, sales amounted to 64.869 billion yuan, and export quota reached 1.863 billion yuan. The three indicators are in the forefront of China's provinces, as shown in Table 1 below.

Table 1 Summary of Enterprise Science and Technology Innovation Activities in Hunan Province in 2015

Enterprise category	New product output value (billion yuan)	Sales revenue of new products (billion yuan)	Number of patent applications (Piece)	Number of patents for effective invention (Piece)
Private enterprise	415.52	416.14	2471	1002
State-owned enterprise	126.14	120.11	139	79
Joint venture	119.23	111.34	710	335
Total	660.89	648.69	3320	1416

Source: According to Hunan Statistical Yearbook of Science and Technology 2016

3.2.3 Innovation Platform and Development of Innovation Ability

In recent years, Hunan Province has taken government procurement to promote innovation as its source, focusing on supporting the development and innovation of scientific research institutes and technological innovation of enterprises. In terms of enterprise technological innovation, relying on the rapid growth of the scale of government procurement, the innovation ability of enterprises in the province can also be rapidly improved [8].

4. Empirical Test of the Role of Government Procurement in Hunan Province in Promoting Independent Innovation

In order to empirically test the promotion role of government procurement, this paper uses DEA model (data envelopment analysis model) to analyze and evaluate the efficiency of independent innovation of enterprises in Hunan Province from 2011 to 2015.

4.1 Selection and Establishment of the Model

The DEA model was selected to evaluate the changes in the independent innovation efficiency of high-tech enterprises based on government procurement in Hunan Province in recent years. The evaluation of independent innovation efficiency can be reflected by both input and output.

Considering government procurement in Hunan Province as a whole system (DMU), the input and output indicators of the kth decision-making unit DMUk (k=1, 2,..., n) are (i=1, 2) and (r=1, 2),

then the DEA model can be established as:

$$\mathrm{Min}\theta$$

$$\begin{cases} \sum_{m=1}^{n} \varphi^m X_i^m \le \theta X_i^k \\ \sum_{m=1}^{n} \varphi^m Y_r^m \le Y_i^k \\ \varphi \ge 0 \end{cases}$$

4.2 Determination of Model Indicators

Considering the characteristics of enterprise innovation and the availability of data in Hunan Province, government procurement volume (X1), per capita government procurement volume (X2) and two types of product procurement volume (X3) are selected as input variables, and sales of innovative products (Y1) and enterprise patent number (Y2) are selected as output variables.

Firstly, in order to verify the rationality of the sample data of Hunan Province's indicators variables selected during 2011-2015, Pearson coefficients between indicators variables are obtained by correlation analysis. The results are shown in Table 2 below. From the results of correlation analysis in the table, we can see that each index variable of government procurement has a positive correlation with each variable of independent innovation output.

4.3 Result Analysis

Table 2 Analysis of the Correlation between Input Variables of Government Procurement and Output Variables of Enterprise Independent Innovation Efficiency

		New product sales revenue	Number of enterprise patents
Government procurement volume	Pearson coefficient	0.764	0.875
	Significance level (Bilateral)	0.002**	0.005**
	Sample size N	5	5
Per capita government procurement	Pearson coefficient	0.515	0.548
	Significance level (Bilateral)	0.023*	0.016*
	Sample size N	5	5
Purchasing quantity of two types of products	Pearson coefficient	0.826	0.831
	Significance level (Bilateral)	0.004**	0.006**
	Sample size N	5	5

Note: * Significant, * < 0.05, ** < 0.01

Using DEAP2.1 software, the original input and output data of 2011-2015 are input into DEA model for processing, and then the independent innovation efficiency of Hunan Province in the past years during the sample period can be obtained, as shown in Table 3 below.

Table 3 Result Table of Independent Innovation Efficiency Based on Government Procurement in Hunan Province

Year	Pure technical efficiency	Scale efficiency	Integrated Technical Efficiency
2011	0.685	0.822	0.563
2012	0.689	0.833	0.574
2013	0.743	0.898	0.667
2014	0.745	0.867	0.646
2015	0.793	0.968	0.768

As can be seen from the table above:

(1) Based on the continuous expansion of the total procurement scale in Hunan Province and the per capita procurement scale in Hunan Province, the innovation efficiency of enterprises in Hunan Province shows an increasing trend at three levels.

(2) Through the DEA model modeling and data analysis, it shows that government procurement has played a positive role in promoting the independent innovation of enterprises in the province.

5. Suggestions on Improving Hunan Government Procurement and Promoting Independent Innovation

5.1 Problems of Policy Procurement Promoting Independent Innovation in Hunan Province

From the results of theoretical analysis and empirical test, the implementation of various government procurement policies in Hunan Province has achieved good results in promoting independent innovation of enterprises in Hunan Province in recent years. However, there are still a series of problems which have become the main factors restricting the efficiency of independent innovation of enterprises in the province. First, the scale of procurement is small. At present, the annual government procurement amount in Hunan Province accounts for only about 2% of the total GDP of the province, which is also manifested in the inadequate support for the independent innovation activities of enterprises in Hunan Province. Second, the two types of products are confused and the proportion of procurement is low. Third, the support for enterprises is lack of specific details and difficult to implement in practice.

5.2 Relevant Suggestions on Improving Hunan Government Procurement and Promoting Independent Innovation

5.2.1 Optimizing the Structure and Scale of Government Procurement

In terms of procurement structure, we should continue to optimize the transformation. The structure of government procurement is closely related to independent innovation, so it is very important to balance the structure of government procurement. In the scope of procurement, we should constantly expand the scale of centralized procurement and the proportion of financial purchase expenditure, so as to play the policy function of government procurement and guide the general public to purchase independent innovation products.

5.2.2 Optimizing the Measuring Standard of Innovative Products and Strengthening the Mechanism Design of Purchasing Two Types of Products

According to the actual situation, Hunan Province should formulate more systematic and

standard measurement indicators of independent innovation products. To actively change policy thinking, we should not only be compulsory, but also reflect fair competition in the market.

5.2.3 Improving the Development Policy of Small and Medium-sized Enterprises and Promoting Independent Innovation of Enterprises

One is to refine and improve the reservation system for small and medium-sized enterprises. Accurate statistics of the proportion of the number and amount of procurement contracts obtained by non-trade enterprises in various regions. The second is to implement the enterprise subcontracting system and subcontract a certain proportion of purchasing items to small and medium-sized enterprises. At the same time, we should also strengthen the supervision in the process of project subcontracting implementation, and implement it to the specific responsible person, so as to ensure the implementation of the subcontracting system.

6. Conclusion

This paper makes an empirical analysis of the effect of Hunan government procurement on promoting independent innovation, and mainly draws the following research results:

(1) Through DEA model modeling and data analysis, empirical test shows that government procurement plays a positive role in promoting enterprise independent innovation.

(2) Put forward a number of policy suggestions, such as optimizing and perfecting the scale and structure of government procurement, formulating measurement standards scientifically, strengthening the mechanism design of two types of products procurement, and improving the development policy of small and medium-sized enterprises, in order to provide some reference and reference for the follow-up formulation of government procurement policy in Hunan Province.

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