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A Review of the Influence of Government R&D Subsidy on Enterprise Technological Innovation

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Abstract

The technological innovation activities of enterprises are often accompanied by the phenomenon of "market failure". Therefore, it is necessary for the government to intervene through corresponding policies to stimulate the enthusiasm of enterprises in innovation. Government R&D subsidy is one of the most common ways. This paper systematically combs the relevant literature at home and abroad from four aspects: the definition of government R&D subsidy and technological innovation, the influence, mechanism and boundary conditions of government R&D subsidy on technological innovation. The results show that: the research on the effect of government R&D subsidy on enterprise technological innovation is still controversial; Existing scholars mostly ignore the possible mediation mechanism between them. There are many research factors affecting the effect of government R&D subsidy, mainly including enterprise scale and property right nature. On this basis, this paper also discusses the future research direction of the relationship between government R&D subsidy and enterprise technological innovation.

Keywords

Government R&D subsidy; Enterprise technological innovation; Influencing mechanism; Influencing factors.

1. INTRODUCTION

Innovation is not only the source of enterprises' competitive advantages and the key to value improvement, but also the core element to drive a country's economic growth and industrial transformation and upgrading [1]. As the active group and the backbone of technological innovation, the improvement of enterprises' innovation ability is of strategic significance for China to carry out the innovation-driven development strategy and realize the improvement of economic quality and efficiency.

The technological innovation activities of enterprises are characterized by public product attributes, externalities and uncertainties, which easily lead to "market failure". Therefore, it is necessary for the government to alleviate the market failure through corresponding policies, so as to stimulate the innovation enthusiasm of enterprises. Government R&D subsidy is one of the most common ways.

However, the actual effect of government R&D subsidy has always been controversial. There are three main viewpoints: incentive effect, crowding effect and interval effect. Then, what is the effect of government R&D subsidy on technological innovation? It is of great theoretical value and practical significance for R&D subsidy to play an important role in promoting technological innovation and innovation-driven development strategy.

In view of this, this paper focuses on the existing literature on the definition of the concept of government R&D subsidy and technological innovation, the impact of government R&D subsidy

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on technological innovation, the mechanism of the impact of government R&D subsidy on technological innovation, and the influencing factors of government R&D subsidy on technological innovation. In order to clarify the mechanism, influencing factors and effects of government R&D subsidy on technological innovation, and try to dig out the content and direction worthy of further research, to provide reference for future related research.

2. DEFINITION OF RELATED CONCEPTS

2.1. Government R&D Subsidy

According to the accounting Standards for Business Enterprises No. 16 - government subsidies, government subsidies can be understood as the monetary assets or non-monetary assets that the government gives to the enterprise in a free way, but the capital invested by the government to the enterprise as an investor is not in the category of subsidies. Government R&D subsidy refers to the part of government subsidy related to R&D activities or scientific and technological innovation given by the government to encourage enterprises to carry out technological innovation, mainly including direct subsidy and indirect tax incentives. Specifically, there are r&d subsidies and rewards for new products, subsidies and rewards for patents, direct subsidies and loan discounts for specific product r&d projects, etc.

2.2. Enterprise Technology Innovation

Schumpeter, an economist, introduced innovation into economics for the first time in The Theory of Economic Development. He pointed out that innovation is to create a new mode of production or a new product, open up a new market or a new source of supply, and form a new system, which mainly includes technical innovation and non-technical innovation. This paper is mainly about the research of technological innovation. Technological innovation refers to the first commercial application of new products, new processes, new systems and new services, and is an innovation activity with market value [2]. Innovation activities have four obvious characteristics: public product characteristics, externalities, high risk and high income.

Existing technology innovation measurement methods can be roughly divided into two categories: one is based on innovation input measurement, such as total r&d investment or intensity, number of R&D institutions and personnel, etc. The second is based on the measurement of innovation output, such as the output value of new products or the number of development, the number of scientific and technological papers published, and the number of patent applications or grants. Among them, patent data is the most commonly used measurement index of technological innovation in academia [3]. Griliches[4], an outstanding contributor to patent data research, argues that patent data is an important source of information for technological innovation, and has advantages over other indicators in terms of data availability and completeness. In addition, patents also have the advantages of low acquisition cost and strong applicability, and can also disclose a lot of information, including information related to the invention and the technical field to which the invention belongs [5].

3. RESEARCH ON THE INFLUENCE OF GOVERNMENT R&D SUBSIDY ON ENTERPRISE TECHNOLOGICAL INNOVATION

As for the research on the effect of government R&D subsidy on enterprise technological innovation, scholars mainly have three viewpoints: incentive effect, crowding effect and interval effect.

3.1. Incentive Effect

Scholars who hold the view of incentive effect believe that government R&D will reduce R&D costs and risks, alleviate corporate financing constraints, stimulate R&D investment, and thus

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promote enterprise innovation activities [6]. Empirically, a large number of domestic and foreign scholars provide evidence for this view. The study of foreign scholars Radas and Anic[7] shows that direct government subsidies can help smes improve their R&D capacity and realize their R&D innovation output. Howell[8] believes that regular government funding for start-ups can stimulate innovation, and early subsidies can double the possibility of obtaining subsequent venture capital, and have a huge positive impact on patent applications and revenue. Richstein [9] found that both grants and subsidized loans help increase tangible investment, employment and income, while grants are more suitable for increasing R&D investment. Domestic scholar Bai Junhong et al. [10] established dynamic and static models based on panel data of different industries, and found that government R&D subsidy encourages enterprises to improve their innovation efficiency. Guo Xiaodan [11] also shows that government R&D subsidies can promote enterprises' R&D activities, the development of major new products, and the increase of enterprises' patent output. Li Lei [12] found that government R&D subsidy significantly promoted the overall innovation output of the new energy automobile industry.

3.2. Inhibition Effect

Inhibition of view research argues that due to the asymmetric information between government and enterprises, government lacks effective information to identify the credibility of enterprises and the spirit of "contract", even can have enterprise produce "rent-seeking" behavior, and effective supervision is relatively lack, therefore, tend to have ex post moral hazard, companies might will R&D subsidy funds put into the project of the science and technology content is low, Or they may choose other profitable non-R&D projects, thus squeezing the r&d investment of enterprises and inhibiting the enthusiasm of technological innovation. Gorg and Strobl [13] studied the benefits of government R&D subsidy on R&D activities of Manufacturing enterprises in Ireland, and found that the self-owned R&D investment of super-large enterprises decreased after receiving government R&D subsidy. Domestic scholars Wang Qiuming et al. [14] constructed a game model, and the results showed that due to the lack of strong supervision and severe punishment, government subsidies were not well implemented and their innovation output did not increase. Based on industrial data, Xiao Wen et al. [15] empirically found that government R&D subsidy has a negative impact on enterprises' technological innovation efficiency due to the preference for "long-term" technologies and the lack of fund use management.

3.3. Interval Effect

Through empirical studies, a few scholars find that there is an interval effect between government R&D subsidy and enterprise R&D innovation activities. Most of the studies show that the relationship between the two is inverted "U" shaped curve. Guellec and Pottelsberghe[16], based on the study of panel data of 17 OECD countries, found that the value of this incentive effect reaches the maximum when the subsidy rate is about 13%, and when the subsidy rate exceeds 25.4%, Will curb the incentive effect of government subsidies. Zhang Xindong and Wu Junjun [17] found that the effect of government R&D funding intensity on the innovation performance of gem listed companies first increases, and then decreases after reaching the critical value. Other scholars also found that only moderate subsidies can significantly stimulate enterprises' new product innovation, while high subsidies inhibit enterprises' new product innovation [18]. However, few scholars found a positive u-shaped relationship between them. For example, Shang Hongtao and Huang Xiaoshuo [19] took Chinese pharmaceutical manufacturing enterprises as samples and found that the government innovation subsidy would significantly promote the r&d input of enterprises in the current period, and had a positive U-shaped relationship to the innovation output in the future period.

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To sum up, it can be seen that scholars have conducted a lot of studies on the impact of government R&D subsidies on enterprise innovation, but their views are not yet unified. In this paper, the main reasons are as follows: there may be multiple mechanism paths for the influence of government R&D subsidy on enterprise technological innovation, and different results will be produced through different transmission mechanisms; Under different influencing factors, the effects of various related influencing mechanisms are different. In addition, different research objects and perspectives will also have different conclusions. Therefore, it is of great significance to explore the mechanism and influencing factors of subsidy effect to understand the relationship between them.

4. RESEARCH ON THE INFLUENCE MECHANISM OF GOVERNMENT R&D SUBSIDY ON ENTERPRISE TECHNOLOGICAL INNOVATION

At present, most scholars establish the direct relationship between government subsidies and enterprise innovation from different theoretical perspectives, ignoring the complex intermediary incentive process that may exist between them [20]. Few scholars believe that government subsidies need to influence enterprises' technological innovation by influencing intermediary variables. For example, the research results of Zou Yang et al. [21] show that enterprise R&D input has a complete intermediary effect on the relationship between government R&D subsidy and enterprise innovation output, that is, the impact of government R&D subsidy on enterprise innovation output is realized through enterprise R&D input. From the perspective of independent innovation willingness and independent innovation behavior, some scholars pointed out that government innovation policies can improve the inefficiency of innovation behavior by strengthening the independent innovation willingness of enterprises, so as to improve the independent innovation effect of enterprises [22].

Through the review of existing literature, it can be found that there are few studies on the mediating effect between government subsidy and enterprise technological innovation, mainly focusing on enterprise research investment, enterprise independent innovation intention and innovation behavior. Therefore, there is still a lot of room for further research on the mechanism of the impact of government subsidies on enterprise technological innovation.

5. RESEARCH ON THE INFLUENCING FACTORS OF GOVERNMENT R&D SUBSIDY ON ENTERPRISE TECHNOLOGY INNOVATION EFFECT

What factors affect the effect of government R&D subsidy on enterprise technological innovation? Scholars have conducted abundant researches on this issue. From the current literature, the influencing factors mainly focus on the enterprise scale, property rights and other aspects.

The research of many scholars shows that the effect of government R&D subsidy is different for enterprises with different scales. However, whether the effect of government R&D subsidy is positively or negatively correlated with the size of enterprises has been supported by scholars. Shang Hongtao and Huang Xiaoshuo [19] found that government innovation subsidy has a significant promoting effect on the financial performance in the future, and this promoting effect is more significant in small-scale enterprises. However, Li Shiqi and Zhu Pingfang [32] found that R&D subsidy only significantly promoted the patent and new product of large enterprises, and had no significant direct impact on the two kinds of innovation output of medium-sized enterprises.

The nature and type of ownership determine the resource allocation of enterprises, and the r&d activities and innovation levels of enterprises with different ownership types are different. Yang Yang et al. [23] believe that compared with state-owned enterprises, government R&D

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subsidy is more conducive to promoting the technological innovation output of private enterprises. GUI Huangbao and Li Hang [24] found that in China's strategic emerging industries at the present stage, the impact of government subsidies on the innovation performance of non-state-owned enterprises is greater than its impact on state-owned enterprises.

In addition to the above two factors, there are other factors affecting the effect of government R&D subsidy, such as marketization degree, political connection, enterprise technology level, internal control, etc. For example, Bronzini [25] studied from the perspective of provincial regions in China and found that governments with higher degree of marketization would have less intervention through R&D subsidies.

6. CONCLUSION AND RESEARCH PROSPECT

Through the review of existing literature and the analysis above, it can be found that there are still controversies in domestic and foreign researches on the effect of government R&D subsidy on enterprise technological innovation, which may be caused by the differences in intermediary mechanism and boundary conditions, thus affecting the subsidy effect.

However, there is a large research space for the study of mediation mechanism. Therefore, the study of mediation effect can be further discussed in the future. For example, government r&d subsidies may affect the technological innovation output of enterprises through market competition and enterprise risk taking. Government R&D subsidies can form corresponding industry entry and exit criteria by influencing the entry or exit conditions of the industry in which enterprises belong, and adjust the degree of market competition in relevant industries [30], so as to play the role of government R&D subsidies on enterprises' innovation output. Government r&d subsidy can increase the capital ownership of enterprises, so that enterprises are able to undertake high-risk innovation projects, that is, to improve the risk bearing capacity of enterprises, and then improve the technological innovation level and performance of enterprises.

There are many studies on the factors influencing the effect of government R&D subsidy, mainly including enterprise scale, property right nature, political connection, enterprise technology level, etc. It can be found that under different boundary conditions, government R&D subsidy will have different effects on enterprise technology innovation. However, in order to better understand the impact of government R&D subsidy on enterprise technological innovation under what boundary conditions, further exploration is needed in the future. This paper argues that it can be discussed from the internal supervision mechanism of enterprises, because under the supervision mechanism, enterprises will make better use of subsidy funds, improve the efficiency of capital utilization, reduce dereliction of duty and violation of regulations, and thus improve technological innovation ability and performance. In addition, from the perspective of corporate culture, corporate culture will affect the decisions and behaviors of enterprises. Therefore, under different cultures, enterprises will make different decisions on the use of government subsidies, which will affect the technological innovation level of enterprises.

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