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Government Subsidies, Additional Deductions for R&D Expenditure and R&D Investment in the Pharmaceutical Industry

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Abstract

In order to explore the effects of government subsidies and the deduction of R&D expenditure on pharmaceutical companies' R&D investment, this article collected relevant panel data of 75 A-share high-tech pharmaceutical companies from 2013 to 2017, and conducted empirical analysis using fixed-effect models. Both the subsidy and the additional deduction policy for research and development expenditure can promote the effect of pharmaceutical companies' R&D investment, but the incentive effect of the additional deduction policy is stronger, which may be related to the characteristics of high investment of pharmaceutical companies. According to the empirical results, this article puts forward suggestions to increase the intensity of deductions for pharmaceutical companies' R&D expenditure.

Keywords

Government subsidies, additive deduction for R&D expenditure, R&D investment, high-tech pharmaceutical companies.

1. INTRODUCTION

The endogenous growth theory proposes that economic growth is not the result of exogenous factors. It is closely related to technological development and national policies. In order to seize the leading position of global competitiveness, countries have adopted technological innovation as an important strategy for the development of a country. At the same time, the development of science and technology makes food and clothing not a problem, and with it comes the emphasis on health. The outbreak of disease, the shortage of medicines …… the development of the pharmaceutical industry cannot keep up with people's needs. In order to solve these increasingly prominent problems, it is imperative to increase the pace of development of the pharmaceutical industry and improve the level of R&D and innovation. R&D activities have the characteristics of public goods, and their externalities and uncertainties make R&D investment inadequate, while the basic function of the government is to achieve the effective allocation of resources. Therefore, the provision of public goods requires government intervention to promote its investment.

In order to promote enterprises' R&D investment, the state has successively introduced a number of fiscal and tax policies. Fiscal policies include government subsidies. Government subsidies are mainly aimed at companies that meet relevant government requirements and provide financial subsidies. In recent years, the Chinese government has continued to increase subsidies to enterprises. According to the statistical yearbook of the high-tech industry, the government's subsidies to pharmaceutical companies in 2016 were 2.2336 billion yuan. Compared with 0.831 billion yuan in 2009, it has nearly tripled. The preferential tax policies mainly include income tax incentives and value-added tax incentives. Among them, the income tax preferential policies include tax-type preferential and tax-rate preferential policies. Tax-type preferential policies include additional deductions for research and development expenditure,

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accelerated depreciation of fixed assets, etc. The latest Caishui [2018] No. 99 stipulates that for all enterprises conducting R&D activities, they can enjoy a deduction of 175% of R&D expenditures in accordance with the terms. The tax-rate preference is mainly recognized by high-tech enterprises with an income tax rate of 15%.

In order to explore the incentive effects of fiscal and tax policies on R&D investment, Li Chuanxi (2016) took 185 high-tech companies listed on the Shenzhen Stock Exchange as research objects and analyzed the impact of government subsidies and preferential income tax policies on the intensity of R&D investment between 2011 and 2014. The final results show that both policies have the effect of stimulating corporate R&D investment. Xie Weimin (2009) In order to explore the role of government R&D funding on independent innovation of enterprises, the Logic model was used to conduct an empirical analysis of relevant financial data of listed companies from 2003 to 2005. The results show that the stronger the government R&D funding intensity, the stronger the R&D expenditure performance. Lou Hetong and Xu Tianjing (2008) believe that tax incentives as an external thrust of corporate R&D activities, by improving the expected benefits of enterprises, reducing risks, increasing the supply of funds to promote the power of corporate R&D innovation and improve their own capabilities, affecting the R&D decisions finally reach the goal of promoting enterprise R&D innovation.

At the same time, some scholars believe that the incentive effect of fiscal and tax policies is limited. Kong Shuhong (2010) In order to analyze the effectiveness of China's tax incentives, the panel data of 30 provinces and years spanning 2000 to 2007 were selected for empirical analysis. The results after the gradual return show that the tax incentives have failed to provide a significant incentive. Zhou Keqing and Jing Zheng (2012) used the tendency score matching method to return the R&D investment, actual tax rate, and deducted amount of GEM listed companies from 2009 to 2011. The research results show that these tax preferential policies in China have weak effects. Dai Chen (2008) selected the panel data of large and medium-sized enterprises in the China Science and Technology Statistics Yearbook from 2002 to 2005 to demonstrate the incentive effect of China's fiscal and tax policies. The results show that government subsidies have not effectively played a role in promoting corporate R&D investment.

Because many scholars have not reached a consensus on the effect of fiscal and tax policies, and the research objects are mostly industrial enterprises or high-tech industries, there is almost no research on specific industries. Based on the above differences, this article focuses on the pharmaceutical industry and selects relevant data for high-tech pharmaceutical companies to analyze the reasons for the differences between the effects of government subsidies and the deduction of R&D expenditure on pharmaceutical companies' R&D investment.

2. THEORETICAL ANALYSIS

2.1. Impact Mechanism of Fiscal and Tax Policies

From the perspective of cost-benefit analysis, fiscal policies such as government subsidies are provided to enterprises in the form of funds, which improves the marginal benefits of corporate R&D activities, and tax policies reduce the marginal costs of corporate R&D by reducing cash flow outflows. As a result, enterprises' R&D investment has increased. As shown in Fig.1, the horizontal axis represents the R&D investment of the enterprise, and the vertical axis represents the marginal cost or profit of the enterprise's R&D activities. When the government implements fiscal and tax preferential policies, the marginal cost of corporate R&D activities MC1 decreases, which moves to the right to MC2. The marginal income increases, moving from MR1 to MR2, and the equilibrium R&D investment moves from point A to point B, which realizes an increase in enterprise R&D investment.

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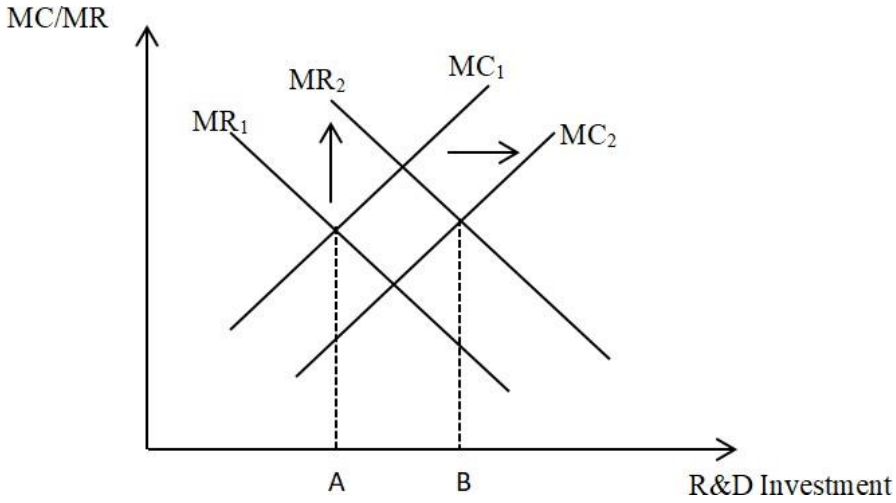

Fig 1. Fiscal and tax policies and corporate R&D investment

From the perspective of information transmission, the government often evaluates and screens enterprises before selecting them to implement fiscal policies. Only when relevant conditions in all aspects of the enterprise meet the threshold requirements of the policy can they enjoy relevant policy preferences. If a company receives relevant preferential policies, this is equivalent to releasing a positive signal to the outside world that the company is operating well. This reduces the adverse selection and moral hazard problems faced by external investors when they screen companies due to insufficient understanding of the company and information asymmetry, which guides the inflow of external resources and promotes the company's R&D investment.

2.2. Characteristics of R&D Investment in the Pharmaceutical Industry

As we all know, pharmaceutical companies must invest in the entire research and development stage. Early compound screening, preclinical research, and later clinical trials all require huge capital and sufficient manpower. Each link is extremely complicated, and the entire process takes more than ten years. Generally speaking, from the initial screening to the final successful market, a drug costs at least ten million, and at most it ranges from one billion to several billion.

The new drug development process is extremely risky and uncertain. Generally speaking, of the tens of thousands of candidate compounds, only a few can go through the screening of preclinical trials, clinical trials and other links. After that, they need to be reviewed and approved by the Drug Administration. There are often only one or two drugs that finally meet the market conditions and enter the market. Once problems occur in these links, all efforts will be discarded, so the risk of pharmaceutical companies' R&D investment is also very high.

3. EMPIRICAL ANALYSIS

In order to explore the effects of government subsidies and R&D spending deductions on corporate R&D investment, this article takes 2013-2017 Shenzhen and Shanghai A-share high-tech pharmaceutical companies as samples, and collects relevant data from Juchao Information Network and Guotai'an Database for demonstration. The empirical model is as follows:

$$Rd = aGov + bDedt + cSize + dOpe + eDebt + fCash + \varepsilon$$

Among them, Gov refers to government subsidies, which is measured by the ratio of corporate R&D expenditure to operating income. Dedt refers to the deduction for research and development expenditure. With reference to Zheng Rong's (2006) definition of R&D

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expenditure plus deduction, it is expressed as (R&D investment * pre-tax deduction ratio * tax rate / total assets). Size is the logarithm of corporate assets and represents the size of the enterprise. Ope and Debt represent operating profit margin and asset-liability ratio, respectively. Cash is the ratio of cash flow to operating income at the end of the period.

For panel data, first test the significance of individual effects and random effects to determine which model is used. The significance P of both tests is 0, so it is necessary to consider individual fixed effects or random effects. The Hausman test is then used to determine whether a fixed effect model or a random effect model is used. However, the traditional Hausman test is not applicable when the model has sequence correlation and heteroscedasticity. To avoid the failure of the traditional Hausman test, the hausman test of the Bootstrap method is used. The null hypothesis is acceptance of random effects. If P <0.05, it indicates that the null hypothesis is rejected and a fixed effect model should be used. The results show that P = 0.0353, rejecting the null hypothesis, and using a fixed effect model to estimate the variables.

In order to reduce the interference of heteroscedasticity, this paper uses two-way fixed effect model and clustering standard error for regression. The regression results are shown in Table 1 below.

Table 1. Regression results of government subsidies and R&D expenditure deduction

Variable	Coefficient	T value
Gov	0.6719**	2.09
Dedt	8.9723***	4.56
Size	0.0024	0.39
Ope	-0.0449***	-3.87
Cash	0.011**	2.28
Debt	-0.0019	-0.19
Number of samples	375	
Within R^2	0.6119	
F value	16.67***	

Note: * indicates that the coefficient passes the t-test with a significant level of 10%, ** indicates that the coefficient passes the t-test with a significant level of 5%, and *** indicates that the coefficient passes the t-test with a significant level of 1%.

It can be seen from the results that the F value is 16.67, and the overall model is significant. Among them, the government subsidies and R&D expenses deductions pass the t test with significance of 5% and 1% respectively, and the coefficients of government subsidies and extra deductions are 0.6719 and 8.9723, respectively. It can be seen that compared with government subsidies, R&D expenditure deduction can more effectively promote the R&D investment of pharmaceutical companies. The emergence of this result may be related to the characteristics of high investment and high risk of pharmaceutical companies. Compared with government subsidies, the additional deductions of 10 million R&D expenditures can have the effect of reducing corporate R&D costs and increasing R&D income, so the incentive effect of the additional deductions of R&D expenditures is more significant.

4. CONCLUSION

According to the empirical results, this paper finds that government subsidies and the deduction of R&D expenditure can promote the R&D investment of high-tech pharmaceutical

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companies, and the effect of the deduction is more significant. In this regard, this article puts forward the following suggestions: First, it is mainly based on the deduction of research and development expenditure, supplemented by government subsidies, and giving full play to the inclusiveness and pertinence of the two. Second, increase the deduction of R&D expenditures. For example, expand the scope of deductions for R&D expenditures, increase the current deduction ratio of 175%, and make the R&D expenditures deduction policy more effective.

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