



R&D Incentive Policy and Upgrading of Enterprise Human Capital Structure

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Abstract. Skilled personnel are an important part of enterprise human capital, and also a key resource for enterprises to carry out R&D and innovation activities. This paper takes the policy of additional deduction for R&D expenses as the entry point, uses the data of A-share pharmaceutical manufacturing enterprises from 2016 to 2021, and empirically tests the impact of tax incentive policies on the upgrading of enterprise human capital structure through the fixed effect model. The study found that the additional tax deduction for R&D expenses increased the demand of enterprises for R&D personnel by easing the financing constraints of enterprises, and promoted the upgrading of the human capital structure of enterprises. According to the research results, this paper puts forward relevant suggestions such as refining and expanding the preferential scope and strengthening skills education.

Keywords: policy of additional deduction for R&D expense; upgrading of human capital structure; pharmaceutical industry; tax incentives

1 Introduction

Since ancient times, the view that "technology is the first productive force" has been widely recognized. At present, various industries have invested a lot of funds and human capital in R&D activities, and it has become the economic reality of market competition to gain the initiative of competition through breakthroughs in core technologies. General secretary proposed that "the only way to innovate is to win people". Human capital is the core factor of production in innovative activities. When carrying out R&D activities, skilled talents should give full play to the value creation function.

Nowadays, with the improvement of people's awareness of life and health, the development of the pharmaceutical industry has attracted much attention. For the pharmaceutical industry, innovation ability is its core competitiveness, and R&D investment is the lifeline of its long-term development. The research and development of innovative drugs in Chinese pharmaceutical enterprises started late. Compared with the international leading pharmaceutical enterprises, we still have much room for development in the breakthrough of key technologies. Therefore, it is necessary for Chinese pharmaceutical enterprises to take market demand as the guide, carry out reasonable innovation, and produce products with strong pertinence and better effect.

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However, R&D activities are characterized by high investment, high risk and positive externalities. Therefore, many enterprises fear that they will be unable to bear the consequences of failure and dare not try easily, so they will not have sustainable and stable innovation ability. At this time, the country's incentive and support policies are needed to give active guidance and substantive subsidies, and the additional tax deduction for R&D expenses is one of them. Since the implementation of the policy, it has gradually increased the deduction ratio and expanded the scope of application. It is the policy of our government to guide enterprises to increase R&D investment and transform to innovation mode. In this context, whether the additional tax deduction for R&D expenses can encourage pharmaceutical enterprises to absorb more technical talents to provide support for their own R&D activities is a matter of concern.

2 Literature Review

From the current literature, many scholars have affirmed the positive role of human capital in economic and social development. Compared with general human capital, innovative human capital has a stronger and more lasting positive effect on the acquisition of competitive advantage^[1]. On the one hand, scholars highlight the significant correlation between advanced human capital, technology upgrading and economic growth by building an advanced human capital index at the macro level^[2]; Or measure the matching degree of human capital and industrial structure in each province, and confirm that appropriate matching degree can significantly improve regional economic efficiency^[3]. On the other hand, they study the impact of human capital on enterprise innovation activities and production efficiency at the micro level. For example, human capital has significantly promoted the improvement of enterprise innovation performance^[4] and total factor productivity^[5].

With regard to the relationship between tax policies and the structure of human capital, some scholars believe that the tax burden will increase the financing constraints of enterprises and have a negative impact on the demand for labor of enterprises^[6], while preferential tax policies can reduce the cost of employment and encourage enterprises to strengthen human resources investment^[7]. Other scholars discussed the impact of individual income tax^[8], accelerated depreciation of fixed assets^[9] and other policies on the structure of human capital of enterprises. A small number of literatures related to the policy of additional deduction of R&D expenses.

In fact, technology intensive enterprises, including pharmaceutical enterprises, especially need human capital to drive scientific and technological innovation. The policy of additional tax deduction for R&D expenses can reduce the cost of using human capital, and its role in the optimization and upgrading of human capital structure cannot be ignored. Based on the above analysis, this paper intends to study the causal relationship of the additional deduction for R&D expenses and the upgrading of human capital structure in enterprises. Then, give appropriate suggestions for policy improvement.

3 Hypotheses

3.1 Relationship Between the Additional Deduction for R&D Expenses and Enterprise Human Capital Structure

In the process of enterprise management, the employment of labor force will be affected by two aspects. First, enterprises need skilled and high-quality labor to create more benefits for enterprises and promote innovative output^[10]; Second, under the condition of limited resources, operating costs limit the number and quality of personnel invested in R&D activities.

The policy of adding deduction for R&D expenses is a preferential tax policy, which reduces the taxable income and actual tax burden of enterprises by adding deduction of the expenses generated by R&D activities before tax. In this way, a large amount of research and development funds invested by enterprises in the early stage will realize the return of funds in a short period of time, which not only transfers risks, but also reduces the marginal cost of R&D activities. From the perspective of tax substitution effect, enterprises may be willing to increase innovation investment with lower risk and cost. But the results of R&D innovation activities are unpredictable, if they fail, enterprises have to bear the loss of capital occupation in the process. According to the policy, the expenses paid to R&D personnel can be deducted before tax according to a certain proportion of the actual amount, which is equivalent to reducing the R&D labor cost. Therefore, as an indispensable element in R&D activities, enterprises will increase the demand for skilled personnel. This policy reflects the government's attitude of encouraging enterprises to innovate, prompting enterprises to increase the employment of R&D personnel. Therefore, this study puts forward the following assumption:

H1: The preferential tax policy of additional tax deduction for R&D expenses will increase the proportion of R&D personnel within enterprises and have a positive role in upgrading the human capital structure of enterprises.

3.2 Mechanism Analysis

The income tax paid by enterprises is a high tax cost that squeezes out after-tax profits. On the premise of keeping the total profit of the enterprise unchanged, adding deduction benefits can reduce the tax cost to save more retained earnings and free cash flow for the enterprise. Generally speaking, there are two channels for daily financing of enterprises: internal and external. Internal financing mainly comes from the enterprise's own funds and the accumulation of funds in production and operation, which has the characteristics of low risk and cost; The external financing sources are mainly equity and debt financing, which has the characteristics of quick timeliness, high cost and asymmetric information. If the company's own capital turnover is poor, it needs to issue equity or loans, which will increase the financing cost and even make the company give up the plan of R&D investment. Therefore, the additional tax deduction for R&D expenses has widened the internal financing space of enterprises and eased the financial pressure of enterprises to a certain extent. Based on the income effect, enterprise managers are willing to use these disposable cash to expand production scale or increase

investment in innovation^{[11][12]}. At the same time, the implementation of supporting policies has released a positive signal to the external financing market, which is helpful to lower the financing threshold and obtain financial support. In this way, enterprises have good expectations for the capital chain and can continue to increase investment in R&D personnel. This puts forward the following assumption:

H2: The policy can ease the financing constraints of enterprises, and then promote the adjustment of human capital structure of enterprises.

4 Method

4.1 Data and Model

Based on the policy of R&D expenses additional deduction, this paper takes A-share listed pharmaceutical manufacturing enterprises from 2016 to 2021 as samples. In the process of empirical analysis, enterprises with missing data of core variables, ST, *ST and delisting are excluded, and all variables are truncated at 1% level to reduce the influence of abnormal values on empirical results. Finally, 1062 valid samples were obtained, all of which were from CSMAR database. Data processing uses Stata.

4.2 Model Setting

In order to verify the impact of additional deduction for R&D expenses on the human capital structure of enterprises, this paper constructs a regression equation as follows:

$$Structure_{it} = \beta_0 + \beta_1 Benefit_{it} + \beta_i Controls_{it} + \mu_i + \sigma_t + \varepsilon_{it} \quad (1)$$

Where

Structure is the explained variable, i.e., enterprise human capital structure. According to whether they are engaged in R&D activities, the employees in the enterprise are divided into R&D personnel and non-R&D personnel, and the human capital structure is measured by the proportion of R&D personnel to the total number of employees in the enterprise.

Benefit is the explanatory variable, i.e., benefits enjoyed from policy. The index is constructed by dividing the tax saving by the total assets of the enterprise, so as to measure the preferential benefit of the additional tax deduction for R&D expenses policy. Since R&D cost are divided into expensed expenditures and capitalized expenditures, and each of them corresponds to different pre-tax deduction rates, the pre-tax deductible amounts of the two expenditures are multiplied separately and added together^{[13][14]}. After the calculation of the index, it was expanded by 1000 times to reduce the number of decimal places. The calculation method is as follows:

Benefits from the additional tax deduction for R&D expenses = (expensed expenditures * current additional deduction ratio + capitalized expenditures * current additional deduction ratio) * enterprise income tax rate/total assets at the end of the enterprise period.

Controls represents all the control variables, including Lev(ratio of liabilities to assets at the end of a year), Roe(ratio of net profit to average net assets), Scale(log of the number of employees), Labor(expenses paying for employees dividing by operating income), Age(age of the enterprise) and Cash ratio(end balance of cash and cash equivalents dividing by current liabilities).

μ_i and σ_t are individual fixed effect and time fixed effect respectively.
 ε_{it} is the error term.

5 Results

5.1 Descriptive Statistic

Table 1. Descriptive Statistics of Key Variables

Variable	Obs	Mean	Std.Dev.	Min	Max
Structure	1,062	13.98	7.984	1.44	42.14
Benefit	1,062	4.37	4.155	0.33	23.50
Lev	1,062	0.30	0.161	0.05	0.75
Roe	1,062	0.09	0.109	-0.38	0.43
Scale	1,062	7.69	0.991	5.56	10.10
Labor	1,062	0.14	0.061	0.04	0.34
Age	1,062	20.11	5.030	6	40
Cash ratio	1,062	1.14	1.371	0.06	8.16

Table 1 shows the descriptive statistical results of core variable. It can be seen that there are great differences in the index of Structure and Benefit, which provides a good data support. What’s more, among the control variables, the standard deviation of Age, Scale and Cash ratio is large, showing obvious heterogeneity among enterprises.

5.2 Relationship Between Benefits Enjoyed From Policy and Human Capital Structure

Table 2. Regression Analysis Results

	Structure	Structure
Benefit	0.133*** (0.045)	0.147*** (0.045)
Lev		-3.665*** (1.299)
Roe		-0.211 (1.308)
Scale		-1.488*** (0.427)
Labor		9.987*** (3.086)
Age		0.376*** (0.072)
Cash ratio		-0.153 (0.121)
Individual	YES	YES
Year	YES	YES
R ²	0.095	0.131

Table 2 reports the regression results. In the first column, no control variables are added. The result shows that the estimation coefficient of Benefit to Structure is 0.133, which is significantly positive at the level of 1%. The second column is the result after adding control variables, and the estimation coefficient is 0.147, which is still significant. The above results show that the R&D expense additional deduction policy promotes the upgrading of human capital structure of enterprises. H1 is verified.

5.3 Mediation Effect

Table 3. Results of the Mediation Effect Test

	Model 1	Model 2	Model 3
	Structure	SA	Structure
Benefit	0.147*** (3.239)	0.001*** (2.809)	0.136*** (2.988)
SA			9.643*** (2.619)
Controls	YES	YES	YES
Individual	YES	YES	YES
Year	YES	YES	YES
N	1062	1062	1062
R ²	0.131	0.903	0.138

Referring to the existing literature, the SA index is an intermediary variable, which is used to reflect the degree of corporate financing constraints ($SA = -0.737 \text{ size} + 0.043 \text{ size}^2 - 0.04 \text{ age}$). SA is a negative value, and the smaller the value, the stronger the financing constraint. Table 3 reports the results of mediation effect, in which model 1 is consistent with the results of Table 2. The coefficient of Benefit in model 2 of the table is significantly positive at the level of 1%, which shows that the R&D expenses additional deduction can really alleviate the financing constraints of enterprises. In model 3 of the table, the coefficients of Benefit and SA are significant at the level of 1%, which are 0.136 and 9.643, indicating that financing constraints play a part of the intermediary effect. From this, we can draw a conclusion that the R&D expenses additional deduction can promote the upgrading of human capital structure of enterprises by alleviating the financing constraints of enterprises to a certain extent. Therefore, H2 is verified.

6 Conclusions

Based on the policy of additional deduction for R&D expenses, this study takes A-share pharmaceutical listed enterprises as the main research object, analyzes the personnel composition of enterprises, and discusses how this tax preferential policy affects the human capital structure of enterprises. The empirical result shows that the additional deduction for R&D expenses significantly increases the proportion of R&D personnel in enterprises and promotes the upgrading of human capital structure. At the same time,

the research also proves that the policy relieves the financial pressure of enterprises. Then, they will carry out R&D activities in a more relaxed environment and optimize resource allocation.

According to the above conclusions, this paper puts forward the following policy suggestions: (1) Formulate differential preferential tax rates for industries. This study confirmed that the policy of additional deduction for R&D expenses plays a great role in the R&D activities of the pharmaceutical industry. Nowadays, the innovation ability of pharmaceutical manufacturing enterprises has far surpassed traditional manufacturing, and the demand for various innovation elements is also higher. In other words, different industries will achieve different results under the same policy setting. Therefore, this paper suggests that the existing industries should be classified according to the innovation demand. For industries with high innovation demand, such as pharmaceutical industry and other technology-intensive industries, the deduction rate can be higher. (2) Expand the preferential scope. The above empirical results prove that the financing constraints of enterprises will affect the investment of R&D personnel. When enterprises borrow money to solve the problem of poor capital turnover in their daily operations, the existing R&D loan interest expenses are not included in the scope of deduction, so this paper suggests that this expenditure can be included. (3) From the perspective of talent supply, we need to pay attention to the matching degree between the education mechanism and the demand of the labor market. We should practice the strategic policy of strengthening the country with talents, increase investment in skills education, train practical and innovative personnel, optimize the labor structure and expand the pool of high-quality talents.

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