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# An Empirical Analysis of the Impact of Fiscal Policy on Technological Innovation Output of High-tech Industry

Yingying Fang[1], Wenting Zhao[2], Qihui Yang[2], Feng Li[2], Xumin Yao[2], Zejiong Zhou[2, *]

[1]School of Accounting, Anhui University of Finance and Economics, Bengbu, Anhui, China

[2]School of Economics, Anhui University of Finance and Economics, Bengbu, Anhui, China

*Corresponding author: aczzj123456@163.com

## Abstract

**By constructing a systematic GMM model, this paper empirically tests the impact of government subsidies and tax incentives on the innovation output of China's high-tech industry. The results show that the promotion effect of government subsidies on the basic innovation output of high-tech industry is stronger than that of application innovation output, while the promotion effect of tax preference on the basic innovation output of high-tech industry is not significant and very weak, but the promotion effect on the application innovation output is very obvious. In terms of subregions, regional differences are still obvious. The positive impact of government subsidies on the basic innovation output of the central and western regions is significantly better than that of the eastern region, while the impact of tax incentives on the basic innovation output of the eastern and central and western regions is not significant.**

## Keywords

**Government subsidy; Tax preference; Technological innovation; GMM model.**

## 1. Introduction

Over the years, China has achieved a wave of rapid economic growth by relying on demographic dividend and huge material foundation. However, with the arrival of the new economic normal, the previous extensive economic development model is no longer applicable. From the current world economic situation, the core of competition among countries is focused on the field of science and technology. Only seeking breakthroughs in technology is the fundamental way to maintain China's sustainable development. As the main body of innovation activities, high-tech industry has always played a mainstay role in the process of building China into a powerful country in science and technology. Accelerating the development of high-tech industry will help to make up for the lack of economic development power caused by the disappearance of demographic dividend. It is an inevitable choice to alleviate the current downward pressure on the economy. However, China's high-tech industry still has problems such as "large but not strong", and still lags far behind the world's leading countries such as the United States, Britain and Japan. The lack of core technology of independent R&D is the primary reason that restricts the development of China's high-tech industry. Therefore, how to improve the ability of independent R & D and effectively improve the output of technological innovation has become the focus of discussion. To speed up the pace of innovation in high-tech industries, it is not enough to rely solely on the strength of the industry itself. It often needs the support of the government to give full play to the leading role of the government. Based on this, this paper will focus on the impact of the government's fiscal policy on the innovation of high-tech industry. By constructing a systematic GMM model, this paper empirically tests the impact of government subsidies and tax incentives on the innovation output of China's high-tech industry.

## 2. Study Design

This paper selects the relevant data of China's high-tech industry for econometric analysis. The economic variables involved mainly include the number of patent applications, sales revenue of new products, government subsidies, tax incentives, degree of marketization, enterprise scale, higher education level, fixed capital stock, etc. Since only the statistical data of relevant core indicators are available in the statistical yearbook of China's high tech industry, and the relevant data in the statistical yearbook of China's high tech industry are only updated to 2016 as of April 2020, this paper uses the inter provincial panel data from 2003 to 2016 to test the impact of government subsidies and tax incentives on the technological innovation output of high-tech industry, The measurement model adopts the system generalized moment estimation method. The specific model construction and variable introduction are as follows:

### 2.1. Model Building

Innovation, as the first driving force leading economic development, has always been at the core of China's industrial upgrading and development. How to improve the output of technological innovation through reasonable fiscal policies is not only the focus of current research, but also the key to industrial upgrading and economic and efficient development. It can be seen from the previous literature that the endogenous nature of the model should be considered in the process of studying the impact of government subsidies on technological innovation. The classical linear regression model is difficult to achieve unbiased estimation in the ideal state because it is difficult to avoid the exogenous assumptions such as missing variables and measurement errors. At present, the mainstream methods to solve endogenous problems include 2SLS, tool variable method and dynamic panel. Considering that the technical output of the explained variable has a certain lag, the systematic GMM method is used to solve the possible endogenous problem of the model. At the same time, this paper subdivides the technological innovation output into basic technological innovation output and applied innovation output, and discusses the impact of the two fiscal policies on the two technological innovation outputs respectively. The basic model is as follows:

$$\begin{aligned} LnPat_{it} = {} & \alpha_0 + \alpha_1 LnPat_{it-1} + \alpha_2 LnSub_{it} + \alpha_3 LnMad_{it} + \alpha_4 LnSca_{it} \\ & + \alpha_5 LnEdu_{it} + \alpha_6 LnFcs_{it} + \alpha_7 LnSub_{it} * LnSca_{it} + \theta_{it} \end{aligned} \quad (1)$$

$$\begin{aligned} LnPat_{it} = {} & \alpha_0 + \alpha_1 LnPat_{it-1} + \alpha_2 LnTax_{it} + \alpha_3 LnMad_{it} + \alpha_4 LnSca_{it} \\ & + \alpha_5 LnEdu_{it} + \alpha_6 LnFcs_{it} + \alpha_7 LnTax_{it} * LnSca_{it} + \theta_{it} \end{aligned} \quad (2)$$

$$\begin{aligned} Ln\,\mathrm{Re}\,v_{it} = {} & \alpha_0 + \alpha_1 Ln\,\mathrm{Re}\,v_{it-1} + \alpha_2 LnSub_{it} + \alpha_3 LnMad_{it} + \alpha_4 LnSca_{it} \\ & + \alpha_5 LnEdu_{it} + \alpha_6 LnFcs_{it} + \alpha_7 LnSub_{it} * LnSca_{it} + \theta_{it} \end{aligned} \quad (3)$$

$$\begin{aligned} Ln\,\mathrm{Re}\,v_{it} = {} & \alpha_0 + \alpha_1 Ln\,\mathrm{Re}\,v_{it-1} + \alpha_2 LnTax_{it} + \alpha_3 LnMad_{it} + \alpha_4 LnSca_{it} \\ & + \alpha_5 LnEdu_{it} + \alpha_6 LnFcs_{it} + \alpha_7 LnTax_{it} * LnSca_{it} + \theta_{it} \end{aligned} \quad (4)$$

In the above formula, i represents each province, t represents the year, $Pat_{it}$ represents basic innovation output, $Rev_{it}$ represents application innovation output, and $Sub_{it}$ and $Tax_{it}$ represent government subsidies and tax incentives respectively. $Mad_{it}$, $Sca_{it}$, Eduit, $Fcs_{it}$ represent the degree of marketization, enterprise scale, higher education level and fixed capital stock respectively. $\theta_{it}$ is a random perturbation term.

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## 2.2. Variable Selection and Data Source

This paper takes technological innovation output as the explanatory variable, subdivides it into basic technological innovation output and applied technological innovation output, and takes government subsidies and tax incentives as the explanatory variables to study the impact of these two fiscal policies on technological innovation output of high-tech industry. At the same time, control variables and interaction variables are added.

### 2.2.1. Explained variable

This paper selects the technological innovation output as the explanatory variable. Considering that the enterprise technological innovation involves the two stages of technological invention and application to the commercial market, the technological innovation output is divided into basic innovation output and application innovation output. Among them, the basic innovation output is measured by the patent application volume of high-tech industry (Pat), while the applied innovation output is measured by the sales revenue of new products (Rev).

### 2.2.2. Explanatory variables

The explanatory variables selected in this paper mainly include government subsidy (Sub) and tax preference (Tax).

About government subsidies. At present, scholars mostly take micro listed companies as the research object, and select the "government subsidy" item in the enterprise annual report to measure. Compared with the data of micro listed companies, the macro industrial data is often more universal. Therefore, this paper selects the provincial data of macro high-tech industries as the sample, and the government subsidies are expressed by the government funds in the R&D funding sources of high-tech industries.

For tax incentives. At present, the measurement methods adopted by the academic circles mainly include the marginal efficiency of R&D tax deduction, b-index method and R&D use cost method. Since the tax preference cannot be directly obtained in the statistical yearbook of China's high tech industry, we can only take indirect measurement according to its definition. According to its definition, tax preference is the amount of tax payable minus the actual tax amount, in which the actual tax amount is also equal to the difference between profits and taxes and profits. Therefore, referring to the practices of Ma Weihong (2011) [1], Liu Haipeng and Chen Dongjing (2017) [2], this paper uses the following formula to calculate the tax preference:

$$Tax_t = (NTR_t - RTR_t) * LR_t = (NTR_t - \frac{LS_t - LR_t}{XS_t}) * LR_t \tag{5}$$

Tax is the tax preference, NTR is the nominal tax rate and RTR is the effective tax rate. According to the original enterprise income tax law before 2007, the maximum enterprise income tax rate is 33%. In view of the availability of data, the NTR from 2003 to 2007 is uniformly set at 33%. Since 2008, the new enterprise income tax law stipulates that the enterprise income tax rate is 25%, so the NTR from 2008 to 2016 is set at 25%. LS is profit and tax, LR is profit and XS is sales.

### 2.2.3. Control variables

Degree of marketization (Mad): the degree of marketization reflects the degree of market competition and affects the efficiency of resource allocation. Generally speaking, in areas with high marketization process, the market can stimulate more innovation vitality, and the technical barriers are relatively low, which also promotes the increase of technological innovation output. Refer to the practices of scholars such as Gong Lixin and LV Xiaojun (2018) [3], it is proposed to use the marketization index in the report on marketization index by provinces in China prepared by Wang Xiaolu and Fan Gang (2019) as the measurement index of marketization degree, which can relatively comprehensively summarize the marketization process of various regions in China [4].

Enterprise scale (Sca): there is no clear conclusion on the research on enterprise scale and technological innovation output. Some scholars believe that large-scale enterprises often have more funds for technological research and development, and are more likely to be favored by the government. Given more scientific research compensation funds, large-scale enterprises are often more risk resistant and occupy a dominant advantage in market competition, and can obtain more technological innovation output. However, some scholars believe that the large scale of enterprises makes it difficult for enterprise decision makers to control the market demand, resulting in the slow development of technology. Referring to the practice of Bai Junhong and Bian Yuanchao (2011), this paper selects the ratio of the annual average number of employees in high-tech industry to the number of enterprises to express the size of enterprises [5].

Higher education level (Edu): according to Romer's endogenous economic growth theory, human capital and technological progress are important factors affecting economic output, and the level of human capital is also an important factor affecting the level of technological innovation, and the level of higher education is an important embodiment of human capital. Here we refer to Wu Fenghua and Liu Ruiming (2013), using the ratio of the number of students in ordinary colleges and universities in each region to the total population in each region to express the level of higher education in each region [6].

Fixed capital stock (Fcs): scholars mostly use the perpetual inventory method to calculate the fixed capital stock. This paper refers to the research of Xu Yuanhua and Sun Zao (2015) [7], starting with the statistical yearbook of China's high tech industry Extract the regional investment amount of China's high-tech industry from 2003 to 2016, and then reduce the fixed asset investment through the fixed asset investment price index. It should be noted that the fixed asset investment price index in the 2017 China Statistical Yearbook is based on 1990, so it is necessary to convert the price index into 2003, then, the annual fixed asset investment is depreciated and converted into the actual fixed asset investment with constant price based on 2003. Then calculate the average growth rate. Finally, assume that the average growth rate of fixed capital stock is equal to the average growth rate of fixed asset investment (flow). The capital stock in the base period 2003 is equal to the fixed asset investment in 2003 divided by the sum of the average growth rate and depreciation rate. Calculate the fixed capital stock after 2003 according to the following formula:

$$K_t = RINV_{t-1} + (1-\delta) * K_{t-1} \tag{6}$$

In the above formula, $K_t$ and $K_{t-1}$ are the fixed capital stock in t period and t-1 period respectively, and $RINV_{t-1}$ is the actual fixed capital investment with constant price in 2003, δ For depreciation rate, refer to the research of Wang Hua (2017) et al. , take δ= 5% [8].

### 2.2.4. Interactive variables

In order to verify that the promotion effect of government subsidies and tax incentives on technological innovation output will decrease with the increase of enterprise scale, here we construct the product terms LnSub*LnSca and LnTax*LnSca of government subsidies and tax incentives and enterprise scale as interactive variables.

### 2.2.5. Data sources

Since only the statistical yearbook of China's high-tech industry has counted the data related to relevant core indicators such as government subsidies and tax incentives of China's high-tech industry, and as of April 2020, the relevant data of the statistical yearbook of China's high-tech industry has only been updated to 2016, this paper determines the research sample as the inter

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provincial panel data of China's high-tech industry from 2003 to 2016, Other relevant data come from China Statistical Yearbook and China Science and technology statistical yearbook over the years. Among them, due to the serious lack of data in Tibet, it shall be eliminated, and the remaining missing data shall be filled by linear interpolation. At the same time, in order to eliminate the volatility of data and possible heteroscedasticity, all indicators are logarithmicized in this paper.

## 3. Analysis of Empirical Results

Fiscal policy is an important factor affecting the technological innovation output of China's high-tech industry. This paper makes a full sample regression analysis using the System GMM model to investigate the impact of government subsidies and tax incentives on the two-stage innovation output of high-tech industry. At the same time, it makes a subregional regression to analyze the impact difference of fiscal policies on the two-stage innovation output of high-tech industry in the East and central and western regions.

**Table 1.** Full sample regression results

| Explanatory variable | Basic innovation output | | Applied innovation output | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| L.lnPat | 0.3267*** | 0.3364*** | | |
| | 21.38 | 22.02 | | |
| L.lnRev | | | 0.5714*** | 0.5569*** |
| | | | 28.78 | 48.99 |
| lnSub | 1.2385*** | | 0.7397*** | |
| | 5.26 | | 6.21 | |
| lnTax | | 0.0892 | | 1.6867*** |
| | | 0.18 | | 7.69 |
| lnMad | 1.7157*** | 2.2473*** | 1.6099*** | 1.7335*** |
| | 5.5 | 5.9 | 10.54 | 11.09 |
| lnSca | 2.3761*** | 0.9469 | 1.7726*** | 3.8435*** |
| | 6.33 | 0.91 | 8.33 | 9.57 |
| lnEdu | 1.0890*** | 1.3557*** | 0.5692*** | 0.4224*** |
| | 11.29 | 8.94 | 6.88 | 3.41 |
| lnFcs | -0.0912 | 0.1527 | 0.1669*** | 0.0270*** |
| | -1.1 | 1.21 | 4.14 | 0.58 |
| lnSub*lnSca | -0.1623*** | | -0.1255*** | |
| | -3.99 | | -5.94 | |
| lnTax*lnSca | | 0.0030 | | -0.2746*** |
| | | 0.04 | | -7.73 |
| _cons | -14.3210*** | -9.3841* | -9.8620*** | -20.6491*** |
| | -6.67 | -1.79 | -7.77 | -9.18 |
| Sargan test | 28.7185 | 27.5728 | 23.2771 | 21.6765 |
| | 0.7241 | 0.7741 | 0.9172 | 0.9498 |
| P value of AR(1) test | 0.0078 | 0.0085 | 0.0107 | 0.0072 |
| P value of AR(2) test | 0.0587 | 0.0573 | 0.3552 | 0.3804 |
| sample size | 390 | 390 | 390 | 390 |

Note: z statistics or t statistics are in brackets, *, * *, * * * respectively represent significant at the level of 10%, 5% and 1%.

### 3.1. Variable Descriptive Statistics

First, through Stata14.0 software obtains descriptive statistics of each explained variable, explanatory variable, control variable and interactive variable. According to the descriptive statistical results, the difference between the maximum and minimum values of several main variables LnPat, LnRev and LnSub exceeds 10, and the difference between the maximum and minimum values of LnTax is also close to 10, indicating that there is a large gap in financial subsidies and technological innovation output among Chinese provinces. The difference

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between the maximum and minimum values of LnMad, LnSca, LnEdu and LnFcs is 1.45 - 5.35. In addition, from the perspective of standard deviation, the standard deviation of LnPac, LnRev, LnSub and LnTax and LnFcs in the control variables are greater than 1, indicating that the data of these variables are not centralized, which further highlights the differences between provinces.

## 3.2. Full Sample Regression Analysis

Considering the possible endogenous problems in the process of model setting, Here, we use systematic GMM Estimation to regress equations (1) - (4) in Section 1 of this chapter. The regression results are shown in Table 1 below. From the results of Table 1, the AR of equations (1) - (4) is (2) The value accepts the original hypothesis at the 5% significance level, indicating that there is no second-order autocorrelation in the model, and the Sargan values are greater than 0.1, indicating that the instrumental variables selected by the model are effective, and it is reasonable to use the System GMM for estimation.

Equations (1) - (2) in Table 1 respectively show the dynamic impact of government subsidies and tax preferences on the basic innovation output of high-tech industry. Equations (3) - (4) show the dynamic impact of government subsidies and tax preferences on the application innovation output of high-tech industry. The regression (1) results show that the impact coefficient of government subsidies is 1.2385, which is significant at the level of 1%. For every 1% increase in government subsidies, the number of patent applications increases by about 1.2385%, indicating that government subsidies can significantly promote the basic innovation output of high-tech industries. In equation (2), although the coefficient of tax preference is positive, it is not significant. It may be because the policy effect of tax preference also has a certain time lag, so its promotion effect can not be reflected in the model. In equation (3), the influence coefficient of government subsidies on the sales revenue of new products is 0.7397, which is significant at the level of 1%, indicating that the "leverage effect" of government subsidies exceeds the "crowding out effect". In equation (4), the influence coefficient of tax preference on the sales revenue of new products is 1.6867, which is also significant at the level of 1%. Comparing the results of equation (1) and equation (2), it can be found that compared with tax preference, government subsidies are more conducive to the increase of basic innovation output of high-tech industry. Comparing the results of equations (3) and (4), it can be seen that the coefficient of tax preference in equation (4) is greater than that in equation (3), indicating that tax preference is more conducive to the improvement of application innovation output than government subsidies. Secondly, by comparing equation (1) and equation (3), equation (2) and equation (4), it can also be found that the impact of government subsidies on the output of basic innovation is significantly greater than that of applied innovation, and the impact of tax incentives on the output of applied innovation is significantly greater than that of basic innovation.

In short, government subsidies are more conducive to the basic innovation output of high-tech industries, and tax incentives are more suitable for the improvement of application innovation output. The main reasons are as follows: first, government subsidy is a direct financial subsidy, which can provide enterprises with the required cash flow in a short time. In nature, it belongs to ex ante subsidy. Enterprises can use this part of subsidy funds for technology R & D, which obviously promotes the improvement of the basic innovation output of technology patents. Second, as an indirect subsidy, tax preference is an indirect benefit to enterprises by reducing or exempting part of the taxes after enterprises engage in production and operation activities. In nature, it belongs to post subsidy. It brings more convenience to the sales of new products in the later stage of high-tech enterprises. Obviously, this part of funding is difficult to be used in early-stage technology R&D activities, which naturally weakens the impact of tax incentives on basic innovation output.

From the perspective of interaction variables, the interaction coefficient between government subsidies and enterprise scale is significantly negative for both basic innovation output and applied innovation output. Although the interaction coefficient between tax preference and enterprise scale is positive when taking the basic innovation output as the dependent variable, it is not significant, and when taking the application innovation output as the explanatory variable, the interaction coefficient between tax preference and enterprise scale is significantly negative at the level of 1%. This also verifies H6 in the previous theoretical part, that is, the promotion effect of government subsidies and tax incentives on technological innovation output will weaken with the increase of enterprise scale.

From the control variables, the degree of marketization, enterprise scale and higher education level can promote the basic innovation output and application innovation output of high-tech industry to varying degrees. The impact of fixed capital stock on basic innovation output is not obvious, but on applied innovation output is significant. With the acceleration of the marketization process, the relative reduction of government intervention and the low efficiency of resource allocation caused by factor distortion have been improved. Enterprises can invest limited R&D resources in the research and development of new products that can meet the

**Table 2.** Regional regression results

| Explanatory variable | East | | | | Midwest | | | |
|---|---|---|---|---|---|---|---|---|
| | Basic innovation output | | Applied innovation output | | Basic innovation output | | Applied innovation output | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| LnPat | 0.3920*** | 0.4213*** | | | 0.3554*** | 0.3862 | | |
| | 5.42 | 5.13 | | | 4.86 | 5.12 | | |
| LnRev | | | 0.3318*** | 0.2925*** | | | 0.5628*** | 0.5177*** |
| | | | 4.31 | 4.07 | | | 8.04 | 4.01 |
| lnSub | 0.4597 | | 1.0854 | | 1.6434** | | 0.3377 | |
| | 1.26 | | 2.63 | | 2.12 | | 0.53 | |
| lnTax | | 0.9324 | | 2.1963*** | | 0.6131 | | 1.4004** |
| | | 1.19 | | 2.72 | | 0.72 | | 2.36 |
| lnMad | 1.2220 | 2.2781*** | 0.99581 | 2.0901*** | 1.4516* | 2.6977*** | 2.1813*** | 2.9070*** |
| | 1.45 | 2.99 | 1.17 | 2.79 | 1.95 | 3.81 | 3.32 | 3.39 |
| lnSca | 0.8275 | 2.9704* | 2.4559*** | 5.8762*** | 3.0152** | 2.0314 | 1.1560 | 8.1150** |
| | 1.2 | 1.88 | 3.51 | 3.71 | 2.54 | 1.22 | 1.17 | 2.47 |
| lnEdu | 1.0022*** | 1.3117*** | 1.0648** | 1.0602*** | 1.1807*** | 0.9093** | 0.6716** | 0.9117** |
| | 2.9 | 3.56 | 2.45 | 2.61 | 3.33 | 2.2 | 2.09 | 2.14 |
| lnFcs | 0.2818* | 0.4647** | 1.1424*** | 1.3210*** | -0.3320* | -0.1218 | 0.0477 | -0.0304 |
| | 1.95 | 2.53 | 6.63 | 6.51 | -1.72 | -0.59 | 0.28 | -0.06 |
| lnSub*lnSca | -0.0363 | | -0.1843** | | -0.2229 | | -0.0544 | |
| | -0.54 | | -2.55 | | -1.64 | | -0.49 | |
| lnTax*lnSca | | -0.1725 | | -0.4163*** | | -0.0837 | | -0.6069** |
| | | -1.36 | | -3.18 | | -0.57 | | -2.29 |
| _cons | -8.1976** | -24.6455*** | -25.0070*** | -46.2352*** | -14.7044** | -12.5709 | -5.4997 | -43.7577*** |
| | -3.08 | -2.65 | -5.34 | -4.99 | -2.19 | -1.44 | -0.98 | -2.65 |
| Sargan test | 9.2632 | 5.1621 | 4.7746 | 4.2996 | 18.1214 | 17.7333 | 13.4736 | 10.9741 |
| | 1 | 1 | 1 | 1 | 0.9882 | 0.9903 | 0.9994 | 0.9999 |
| P value of AR(1) test | 0.0833 | 0.0464 | 0.0509 | 0.0505 | 0.0163 | 0.021 | 0.0197 | 0.0332 |
| P value of AR(2) test | 0.2701 | 0.3372 | 0.3969 | 0.4456 | 0.0916 | 0.0755 | 0.3977 | 0.6157 |
| sample size | 143 | 143 | 143 | 143 | 247 | 247 | 247 | 247 |

Note: z statistics or t statistics are in brackets, *, * *, * * * respectively represent significant at the level of 10%, 5% and 1%.

market demand, which can undoubtedly more effectively drive the innovation output and innovation performance of high-tech industries. Generally speaking, large enterprises have more capital than small enterprises, and their anti risk ability is stronger than small and medium-sized enterprises. They have the ability and confidence to invest funds in more innovative R&D projects, which leads to the innovation output of large enterprises is often higher than that of small and medium-sized enterprises. The improvement of education level can significantly improve the quality of workers, and the improvement of workers' quality will further promote the innovation and development of local high-tech industries.

### 3.3. Subregional Regression Analysis

The regional regression results are shown in Table 2. The AR (2) values in equations (1) - (8) accept the original hypothesis at the 5% significance level, which also shows that there is no second-order autocorrelation in the model, and the Sargan values are greater than 0.1, which also shows that the instrumental variables selected by the model are effective, so it is reasonable to use the System GMM to estimate the model. Among them, equation (1)- (4) Equations (5) - (8) are the effects of government subsidies and tax preferences on the two innovative outputs of the eastern coastal areas.

Compare equations (1) and (2) (5), it can be found that government subsidies only play a significant role in promoting the inland areas of the central and western regions, and the impact coefficient on the eastern region is positive, but not significant. The reason may be that the distribution of high-tech industries in the western region is relatively small, there is a law of diminishing marginal utility in the process of putting government subsidies into use, and the capital investment has a significant impact on the improvement of the output efficiency of technological innovation, the promotion effect will be better. Therefore, given the same amount of subsidy funds, the output improvement effect of the central and western regions will be significantly higher than that of the eastern region. In contrast, the development of high-tech industry in the eastern region has reached a high level. Therefore, it will be more difficult to continue to improve innovation output by increasing subsidies on the existing basis. Comparing equations (2) and (6), it can be seen that tax preference has no significant impact on the basic innovation output of the eastern and central and western regions, which shows that tax preference can not play a role in promoting the basic innovation output of high-tech industries either on the whole or in subregions.

For application innovation output, by equation (3) and (7), it can be seen that government subsidies have no significant impact on the application innovation output of high-tech industries in both the east and the central and western regions. The main reason is that government subsidies belong to ex ante subsidies, and have a certain lag in the impact on the application innovation output in the transformation stage of technological achievements and market operation stage, so they do not play a significant role in promoting the application innovation output from the regression coefficient. Comparative equation (4) And (8), it can be seen that both in the east and the central and western regions, tax preference promotes the output of application innovation at a significant level of 1%, and the role of tax preference in promoting the output of application innovation in the East is greater than that in the central and western regions. This may be due to the relatively backward development of the central region, the large gap between the production and operation of high-tech industries and the developed eastern regions, and the tax preference. As an indirect subsidy, preference is directly linked to the operation of enterprises. Therefore, it is obviously difficult for the underdeveloped central and western regions to compete with the developed eastern regions in the degree of benefit. As reflected in the regression model, the impact coefficient of tax preference on the sales revenue of new products in the eastern region is 2.1963, and the impact coefficient on the central and western regions is only 1.4004. The former is 56.83 percentage points higher than the latter. The research results of Cui Yeguang and Jiang Xiaowen (2017) just support this view [9].

In terms of control variables, from the regression results, the degree of marketization, enterprise scale and higher education level generally promote the technological innovation output of high-tech industries in the East and central and western regions, and the reasons are the same as before. The effect of fixed capital stock on the output of technological innovation in the eastern region is obvious, and the impact on the output of technological innovation in the central and western regions is negative and not significant. This may be due to the relatively sound infrastructure and high degree of marketization in the eastern region, which is more conducive to the cohesion of scientific and technological innovation resources, give full play to the production efficiency of scientific and technological innovation elements, and then promote the output of technological innovation. Let's look at the interaction between government subsidies, tax incentives and enterprise scale. Although some results are not significant, they also show a negative impact trend, which further shows that the expansion of enterprise scale may reduce the promotion effect of fiscal policy on technological innovation output of high-tech industry.

## 4. Conclusion

Using the dynamic panel model, this paper discusses the dynamic impact of government subsidies and tax incentives on the technological innovation output of high-tech industry, in which the innovation output is also subdivided into the basic innovation output in the technology R&D stage and the application innovation output in the achievement transformation stage. On the whole, the promotion effect of government subsidies on the basic innovation output of high-tech industry is stronger than that of application innovation output, while the promotion effect of tax preference on the basic innovation output of high-tech industry is not significant and very weak, but the promotion effect on the application innovation output is very obvious. It shows that government subsidies are more conducive to the improvement of basic innovation output, and tax incentives are more conducive to the application of innovation output. In terms of subregions, regional differences are still obvious. The positive impact of government subsidies on the basic innovation output of the central and western regions is significantly better than that of the eastern region, while the impact of tax incentives on the basic innovation output of the eastern and central and western regions is not significant; In terms of applied innovation output, government subsidies have no obvious promoting effect on the eastern and central and western regions, while the effect of tax preference on the eastern region is better than that in the central and western regions. Therefore, we should face up to regional differences, implement differentiated fiscal policies, and adjust measures to local conditions, which is the key to improving the overall innovation ability of China's high-tech industry.

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