



# Tax Policy, Technological Innovation and Industrial Structure Upgrading – Based on Mediating Effect Model Test

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**Abstract.** The tax revenue promotes structure optimization and upgrading is a development path that our country has been actively exploring. Starting from the mediating variable of technological invention, this paper constructs the theoretical analysis framework of tax policy, industrial structure change, and makes time series data to analyze the mediating effect, aiming at characterizing tax policy on industrial structure change. The results show that the macro tax burden has a negative effect on the upgrading of industrial structure and inhibits the upgrading of industrial structure. The macro tax burden has a negative effect on technological upgrading, which restrains the input of technological invention and affects the industrial structure change. There is a quantitative mediating effect of “tax policy-technological innovation-industrial structure upgrading”.

**Keywords:** Tax Policy · Technological Invention · Industrial structure change

## 1 Introduction

New development pattern is the main melody of the present economic development in our country. The 14th Five-Year Plan points out that we will enhance the modern industrial system, and stick to innovation-driven development. Taxation not only plays a role in ensuring fiscal revenue, but also irreplaceable to the government’s macro-regulation of the economy. As one of the means of economic regulation by the government, tax policy has a certain impact on the industrial structure change and technological invention. It could not be ignored that technological innovation is a key node in the process of tax policies on industrial structure changing.

## 2 Literature Review

An Tiifu (2011) [1] points out that tax revenue promoting the structure and changing optimization of industry is also an important development path that China has been actively exploring. Chen Mingyi et al. (2021) [2] studied enterprises of market economy subject from a micro perspective. From a macro perspective, scholars’ research focuses

on two points. The first is the impact of tax competition. Zhang Guoqing and Li Hui (2019) [3] analyzed the impact of total tax competition and tax division competition on the changing of industry under the consideration of spatial impact relationship and industrial structure changing, and also analyzed the regional heterogeneity of the impact relationship. The second is the influence of macro tax burden on industrial structure changing. Gan Xingqiong and Jiang Bingwei (2019) [4] used panel threshold model to focus on the effectiveness of tax on industrial structure changing, and concluded that macro tax burden increase would change from not conducive to industrial structure transformation to conducive to industrial structure transformation. Zhang Xuesheng (2021) [5] studied the relation between government tax competition and industrial structure changing from the perspectives of structure and aggregate, analyzed it and drew conclusion that there were aggregate and structural mediating effects. The research provides a new perspective on the relationship of tax revenue. In the end, scholars focus on the important influence of factors on the changing of industrial structure from many factors that affect the changing of structure. Among them, tax has a beneficial and negative impact on technological innovation. It is worth thinking about whether the effect of preferential tax policies on the upgrading of industrial structure still holds in terms of the overall tax burden. This article will conduct further discussion and research on the intermediary effect of tax policy, the structure and changing optimization of industry, which is based on the time series data of our country from the overall tax policy level of tax reduction and fee reduction.

### **3 Theoretical Analysis and Research Hypothesis**

#### **3.1 The Mechanism of Tax Policy Promoting Invention**

The promotion influence of tax policy on technological invention is mainly reflected in tax preferential policy. According to the theory of quasi-public goods, the technological innovation of enterprises has some problems, such as high risk, externality of earnings and asymmetry of information. Li Yingzhou [6] believe that pure market resource allocation cannot achieve the optimal allocation of resources, so the government needs to bear certain risks to make up for the loss of its main body. Tax as a tool of government regulation of the economy, corresponding to the level of technological innovation, the concrete measures include the technology innovation subject to claim additional deduction tax, low tax rates, and a series of preferential measures to further undertake the risk and cost of main body of technical innovation and differentiation, and improve the competition mechanism to ensure the external market environment. From a macro perspective to the market main body tax, in particular, can directly affect the costs and benefits of the business, tax breaks for technology innovation, will be more able to direct its resources more configuration on technology innovation level, to promote innovation is to meet the strategic plan. Thus, the paper raises the following hypotheses:

H1: Preferential tax policies can promote technological innovation by reducing costs and sharing risks.

### 3.2 The Mechanism of Technological Invention Promoting Industrial Structure Changing

The evaluation standard of whether the industrial construction restructuring is upgraded in the total economic volume to judge whether the industry is upgraded. It is known that the more proportion of high-tech industry, high-end manufacturing industry and other technology-intensive industries and the tertiary industry in the secondary industry, the more perfect the industry. The action system of technological invention on industry restructuring is mainly reflected in two aspects. First, innovation can give birth to a new industrial structure. Kong Qixiang [7] believe that the scientific and technological achievements of a series of technological revolutions in recent years can be transformed into real productivity, and the spillover effect can be improved through industrial integration and agglomeration, thus promoting the change of technology-intensive industries. On the other hand, technological innovation can enhance the change of traditional industries. Thus, this paper comes up with the following hypotheses:

H2: Technological change promotes the restructuring of industrial structure by giving birth to new industrial construction.

To sum up, tax policy can reduce the cost and risk of technological innovation by enterprises through a series of preferential measures, so as to promote enterprises to continuously increase the input, and finally achieve the purpose of technological creation. Under this mechanism path, the increase of tax policy, especially tax preferential policy, can play a certain incentive role in the changing of industrial construction. Therefore, this paper raises the following hypotheses:

H3: Tax policies can finally promote the changing of industrial construction by enhancing technological creation.

## 4 Research Design

### 4.1 Index Selection and Data Sources

The paper measures and empirically analyzes the indicators related to the structure and changing optimization of industry. Among them, the tax policy measures through macro tax burden, as the main body of changing of industrial construction is the enterprise, and is the biggest tax factors impact on the business value added tax and enterprise income tax, therefore, this article selects the interpretation of the variable macro tax burden (TP) by value-added tax (VAT) income and the business income tax in our country tax revenue (CIT),  $TP_t = \sum(VAT_t + CIT_t)$

Among them, VAT tax revenue (VAT) is the sum of VAT and business tax revenue, excluding import VAT tax, in order to ensure data integrity and flatness, due to the large difference and different caliber of tax changes before and after the reform in 2016. Business income tax revenue is the total income tax revenue of domestic and foreign enterprises.

For the measurement and selection of technological innovation indicators, different scholars choose different indicators from different perspectives for measurement. For investment, they include fiscal expenditure in fiscal expenditure, per capita R&D expenditure, and the level of R&D investment. As for output, it includes patents authorized,

the amount of R&D institutions, the quantity of colleges and universities, and as for the scale of high-tech industries. Mentioned above, it learns the technological creation, focus on the tax policy on the improvement of the enterprise technology innovation cost and risk, so pay more attention to technology innovation input part of the indicators, using Gu Hongwen [8], such as measuring technology innovation thinking, selection of R&D investment intensity as intermediary variable technology innovation investment (Inn) measure.

In the study of industrial construction upgrading, the paper mainly focuses on the consequence of structure restructuring, that is, whether the industrial structure reaches the predetermined target. Therefore, for the explained variable industrial structure changing (Str), which is specifically expressed as the percentage of the output value.

In addition, aiming at reducing the influence of other socioeconomic variables on the research variables, this paper selects three control variables: level of opening to the outside world (To), urbanization rate (Urb) and government expenditure level (Gc). Among them, the level of openness to the outside world (To) is the scale of the total import and export volume of China to the corresponding year's GDP value; Urbanization rate (Urb) is the scale of urban populations to the whole population in China; Government expenditure level (Gc) is the scale of total fiscal expenditure to GDP value.

Due to the lack of partial data before 2000 and to fit the development of China at the present stage, this paper adopts 21 years of relevant data from 2000 to 2020 to make up the time series data for empirical analysis. To eliminate the time trend, the relevant data are logarithmic processed. The explained variable is the changing of industrial construction, the explanatory variable is the macro tax burden, and the technological invention is the intermediary variable. At the same time, the urbanization rate and the level of government expenditure are taken as the control variables. The specific data content is from China Statistical Yearbook and China Tax Yearbook. Specific indicator selection, basic meaning and descriptive statistics are shown in Table 1 below.

**Table 1.** Descriptive analysis

Variable	Observed	Mean	Sd	Max	Min
ln-Str	21	4.649	0.176	4.971	4.47
ln-TP	21	10.549	0.832	11.509	8.912
ln-Inn	21	0.513	0.261	0.875	0
ln-To	21	3.778	0.236	4.162	3.456
ln-Urb	21	3.901	0.177	4.157	3.59
ln-Gc	21	3.044	0.152	3.24	2.763

## 4.2 Model Setting

According to the above analysis, to test the mediating result of technological innovation on the upgrading of industrial construction, this paper explores the intermediary effect of

tax policy on the upgrading of industrial construction through the distribution regression method, and constructs the mediating effect model as follows:

$$\ln Str_t = \alpha_1 \ln TP_t + \alpha_2 CV_t + c_1 + \varepsilon_{1t} \quad (1)$$

$$\ln Inn_t = \beta_1 \ln TP_t + \beta_2 CV_t + c_2 + \varepsilon_{2t} \quad (2)$$

$$\ln Str_t = \gamma_1 \ln TP_t + \gamma_2 \ln Inn_t + \gamma_3 CV_t + c_3 + \varepsilon_{3t} \quad (3)$$

In the above three models, the subscript  $t$  represents the corresponding year of each variable. At the same time, since the variable is a time series, the logarithmic transformation of every variable is to reduce the influence of heteroscedasticity.  $\ln Str$  represents the logarithm of the advanced industrial construction,  $\ln TP$  expresses the logarithm of the macro tax burden, and  $\ln INN$  represents the logarithm of the R&D investment intensity. Meanwhile,  $CV$  is a series of control variables,  $\varepsilon$  is a random error term,  $C$  is a constant term, and  $\beta_1 * \gamma_2$  is the mediating effect transmitted through technological innovation.

## 5 Empirical Results Analysis

### 5.1 Main Effect Test

In this paper, Stata14 is used to perform stepwise regression on the pattern, and the return to the results appear in Table 2 below. Through the distribution regression analysis, we can see that the first coefficient  $\alpha_1$  is passive at the conspicuousness level of 1%, showing that the macro tax burden and industrial construction changing have clear negative correlation, that is, with the decrease of the macro tax burden, the standard of industrial construction changing is increasing. At the same time, the coefficient  $\beta_1$  is negative at the conspicuousness level of 5%, and also shows that the macro tax burden has a conspicuous negative level on technological construction. The negative signs of coefficients  $\beta_1$ ,  $\gamma_1$  and  $\gamma_2$  also indicate that the mediating effect path of macro tax burden on industrial construction changing is feasible. On the basis of Table 3 and the mediating effect diagram above, it is shown that the value of coefficient  $\alpha_1$  is  $-0.331$ , that is, the total effect of macro tax burden on industrial structure upgrading is  $-0.331$ . Meanwhile, the coefficient  $\beta_1$  is conspicuous at 5%, but the coefficient  $\gamma_2$  is not conspicuous, so it is necessary to further judge whether the mediating effect is conspicuous by Sobel test.

In control variable ways, high-level industrial construction has significantly negative effects in our country, this paper argues that mainly import and export goods is proportional to the second industry development level, with the total increase of import and export goods, the ratio of the third industry of secondary industry will decline. In three steps rate coefficient regression model in the town are significantly positive, the urbanization level of technological invention and upgrade of industrial structure has significant positive effect, this paper argues that the main reason may be brought by the urbanization of the technical level of the abundant human resources to improve and upgrade of industrial structure have a positive impact, Of course, the impact of urban education level needs to be further considered, which will not be repeated here. In model 2, the level of government consumption has a conspicuous positive effect on technological innovation, indicating that the expansion has an active effect on the improvement of technological innovation level.

**Table 2.** The evaluation results of tax policy on industrial construction changing

variable name	Model1 lnStr	Model2 lnInn	Model3 lnStr
lnTP	(0.0981) -0.331***	(0.114) -0.292**	(0.112) -0.424***
lnInn			-0.317 (0.206)
lnTo	-0.214*** (0.0658)	0.250*** (0.0767)	-0.135 (0.0815)
lnUrb	2.324*** (0.388)	2.016*** (0.452)	2.964*** (0.558)
lnGc	-0.0954 (0.229)	1.192*** (0.267)	0.282 (0.330)
Constant	0.179 (1.123)	-8.842*** (1.308)	-2.624 (2.116)
Observations	21	21	21
R-squared	0.975	0.985	0.978

**5.2 Mediating Effect Test**

In the analysis of the mediating effect of the structure and changing optimization of industry, it is observed that the coefficient  $\gamma_2$  in model 3 in Table 2 is not significant of technological change on the structure and changing optimization of industry, and the coefficient  $\beta_1$  is significant, so it is essential to further carry out the Sobel test to judge whether there is a mediating effect. The results can be seen in Table 3 below.

**Table 3.** Results of Sobel test on the mediating result of tax policy on industrial structure upgrading

	Coef	Std Err	Z	P >  Z
Sobel	0.09258778	0.07022561	1.318	0.01873586
Goodman-1 (Aroian)	0.09258778	0.07406547	1.25	0.02112702
Goodman-2	0.09258778	0.06616327	1.399	0.01616981
a coefficient	-0.292076	0.114277	-2.55586	0.010593
b coefficient	-0.316999	0.205977	-1.539	0.123804
indirect effect	0.092588	0.070226	1.31843	0.187359
direct effect	-0.424081	0.111733	-3.79549	0.000147
total effect	-0.331493	0.098098	-3.37922	0.000727

As can be seen from Sobel-Goodman test, P value of Goodman-1 (Aroian) coefficient is 0.02112702, indicating that macro tax has a conspicuousness mediating result on industrial structure upgrading at the standard of 5%. It can prove hypothesis H1, H2

and H3. Meanwhile, in the mediating effect test, it can be seen intuitively that the indirect effect is 0.092588, the direct effect is  $-0.424081$ , and the total effect is  $-0.331493$ . Furthermore, We can calculate that the proportion of indirect effect in total effect (indirect effect/total effect) is  $-0.27930503$ , the proportion of indirect effect in direct effect (indirect effect/direct effect) is 0.21832559, and the proportion of total effect in direct effect (total effect/direct effect) is 0.78167441. In conclusion, the decline of macro tax burden is conducive to promoting the structure and changing optimization of industry, and the mediating effect path of “tax policy, technological innovation and industrial structure upgrading” has also been verified.

## 6 Conclusions and Suggestions

Starting from the mediating variable, the paper constructs the theoretical analysis framework of tax policy, the structure and changing optimization of industry, and uses time series datum to analyze the mediating effect, aiming at characterizing the influence of tax policy on industrial construction changing and its transmission path. In this paper, we should pay attention to the following three aspects:

First, the tax burden has an obvious inhibitory effect on industrial construction changing. As for the process of tax policy reform, we should take care to the reduction of tax burden, the tax burden of micro, small and medium-sized enterprises, which has an obvious impact on the increase of technology input cost and technological innovation risk. Tax incentives should be increased. Second, some time recently, tax reduction and fee reduction” are positive role in reducing the tax burden of enterprises, but pay attention to the proportion between direct tax and indirect tax, reduce the tax burden from the tax structure, save tax costs, improve the scale of direct tax, decrease the scale of indirect tax. Third, invention for the promotion of industrial change is also obvious, but can be seen in the intermediary effect analysis, macro tax burden by influencing the technological innovation, had inhibitory effect on industrial structure upgrade, so in the process of reform of tax policy to incline to the tax policy of technology innovation, especially intensify tax incentives of high and new technology industry.

The national “14th Five-Year Plan” has put forward new guidance and requirements. During tax policy reform, people would still pay attention to the balance between tax burden and tax efficiency. This article is constrained by the limitation of data acquisition and empirical analysis level, and does not analyze the intermediary result of tax policy and industrial construction changing of tax system construction, hoping to deepen the analysis of the influence of tax policy on the structure and changing optimization of industry, in order to provide theoretical reference for our tax policy reform.

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