

Empirical Analysis on the Influencing Factors of Fiscal and Tax Revenue in Sichuan Province Based on Multiple Stepwise Regression

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Abstract: Tax is closely related to national economic development. Various macroeconomic variables comprehensively affect the scale of tax revenue. Therefore, analyzing the influencing factors of tax revenue is an important direction to study China's current economic recovery and promote tax growth. As an important province in Southwest China, Sichuan has important research value. Therefore, this paper collects the macroeconomic data of the province for 25 years, and establishes a multiple stepwise regression model. The results show that the added value of the secondary industry, the per capita disposable income of rural households and the total amount of import and export trade have a significant positive impact on the total tax revenue of Sichuan Province, and the internal expenditure of R&D funds for high-tech industries has a negative impact on the tax revenue of Sichuan Province. Based on the research conclusions of this paper, policy suggestions are put forward from the perspectives of industrial structure, income distribution and R&D cost investment, so as to provide a basis for promoting the steady return of the national economy of Sichuan Province.

Keywords: Sichuan Province, tax revenue, influencing factors, multiple regression

1. Introduction

Tax revenue is the main component of government revenue and the main influencing factor of economic development. It plays an important role in the development and construction of the national economy. Therefore, tax growth is a prominent manifestation of the stable development of China's economic operation. From 1995 to 2019, the tax revenue of Sichuan Province increased by 20.82 times, but the total GDP of Sichuan Province increased by 48.89 times in the same period. It can be seen that the multiple of GDP growth is more than twice that of tax revenue. In view of the large contrast between the regional GDP and the increase multiple of tax revenue in Sichuan Province, the relevant departments of Sichuan Province should strengthen the governance of tax revenue.

Especially in 2020, China's economy is facing a huge crisis. The study of tax level is of great practical significance to promote the restoration of China's economic order. The study of tax influencing factors can help the country more effectively implement macroeconomic regulation and control, and provide a theoretical basis for regulating the redistribution of national income and formulating perfect and effective tax policies. Starting from the main factors of tax revenue growth in Sichuan Province, this paper will demonstrate it from five parts; The first part is the literature review, which reviews the relevant literature on the factors affecting tax revenue. The second part is the theoretical analysis and data sources. Due to the selection of many indicators, the third part first screens the index system through the method of stepwise regression, and the fourth part makes empirical analysis and relevant tests. Finally, according to the empirical results, this paper puts forward policy suggestions to provide theoretical basis and decision-making reference for the government's tax system reform and optimal management.

2. Literature review

There are many factors affecting tax revenue, such as the level of economic development, fiscal expenditure, fixed asset investment and so on. Li Weigang (2014)^[1] believes that the factors affecting tax growth are diverse, mainly including economic growth, tax system structure, price factors and tax collection and management level. Sun Yudong (2009)^[2] believes that the factors affecting tax growth mainly include price, economic growth, tax policy adjustment, tax collection and management, etc; An

Tifu (2015)^[3] believes that tax revenue is mainly affected by changes in price and economic structure. Ouyang Ruolan (2010)^[4] believes that there is a positive correlation between fiscal expenditure, commodity retail price index and GDP3 and tax revenue.

In the research literature on the influencing factors of tax revenue, some scholars use the method of theoretical review, and most scholars use the empirical research method. In the empirical verification analysis, the most used method is multiple linear regression. Wang Yue (2015) studied the influencing factors of tax revenue in Jiangsu Province by using multiple regression method, and concluded that the optimization and upgrading of industrial structure played a major role in the growth of tax revenue. In using multiple regression model to analyze the influencing factors of tax revenue, some scholars use factor regression to systematically study the influencing factors of tax revenue. Yang Deqian (2014)^[5] deeply analyzed the linkage effect of various factors and indicators affecting China's tax revenue from the two levels of China's tax scale and tax structure through principal component regression and factor regression methods. Li Jianjun (2013) calculated the collection and management efficiency of the national IRS, local taxation bureaus and major taxes through the inter provincial panel data. The results show that the tax collection and management efficiency can promote China's tax revenue

To sum up, scholars' research shows that the influencing factors that determine tax revenue change due to the changes in different regions and different times. However, whether it is for the national factor analysis affecting tax revenue or for the factor analysis affecting tax revenue in a region, the analysis conclusions are exactly the same

The above literature analyzes one or several aspects of the factors affecting tax revenue, but due to different data selection and different angles of analysis, the results are still controversial in revealing the impact of various economic factors on tax revenue: among the economic factors affecting tax revenue, what is the contribution rate of various factors to tax revenue growth? What proportion? These problems need to be solved urgently. At the same time, there is a relative lack of literature research in Sichuan Province. Therefore, this paper will focus on the economic factors affecting tax revenue in Sichuan Province, subdivide them and make corresponding empirical research.

3. Theoretical analysis and data sources of influencing factors of tax revenue in Sichuan Province

Drawing on the research results of previous scholars and fully considering the measurability and availability of the variables involved in the influencing factors of tax revenue, this paper divides the factors affecting tax revenue into four primary indicators: economic factors, residents' living standards, innovation degree, government factors and macro factors, and subdivides 14 secondary indicators. See Table 1 for details:

Table 1: Influencing factors and indicators of tax revenue.

Primary index	Secondary index
Economic factors	Investment in fixed assets (100 million yuan) (x_1)
	Consumer price index (last year = 100)(x_2)
	Total retail sales of social consumer goods (100 million yuan)(x_3)
	Added value of secondary industry (100 million yuan)(x_4)
	Added value of tertiary industry (100 million yuan)(x_5)
	Import and export trade volume (USD 10000)(x_6)
Residents' living standards	Per capita disposable income of Urban Households (yuan)(x_7)
	Per capita disposable income of Rural Households (yuan)(x_8)
Degree of innovation	Internal expenditure of R&D funds for high-tech industry (10000 yuan)(x_9)
Government factors	Administrative expenditure / financial expenditure (x_{10})
	Non tax revenue / fiscal expenditure (x_{11})
Macro factors	Natural population growth rate (%) (x_{12})
	RMB exchange rate (%)E(x_{13})
	Interest rate level (%)R(x_{14})

The sample data in this paper is the index variable data affecting tax revenue in Sichuan Province

from 1995 to 2019. At the same time, the secondary indicators are used to quantify the primary indicators. The data used in this paper are mainly from the statistical yearbook of Sichuan Province from 1996 to 2020. The interest rate level and RMB exchange rate are from the National Bureau of statistics and the financial information network.

4. Theoretical analysis and data sources of influencing factors of tax revenue in Sichuan Province

Based on the analysis of influencing factors in theory, but there may not be significant impact in practice. Considering the strong correlation between economic variables, selecting too many indicators for modeling will produce the problem of multicollinearity. The stepwise regression method is used to screen the original indicators, and the index system of influencing factors of tax revenue in Sichuan Province is optimized through stepwise regression.

Added value of secondary industry, per capita disposable income of urban households, total import and export, per capita net income of rural households, internal expenditure of R&D funds for high-tech industries. Model i selects the first i predictors. After stepwise regression, the results are shown in Table 2. In the regression model, the modified decisive coefficient R^2 can be used to measure the fitting degree between the observer and the established model. Here, with the increase of variables, R^2 gradually increases, and the final model 5 $R^2=0.993$ is close to 1, indicating that the interpretation degree of the model on the total tax revenue has reached 99.3%, indicating that the model has a good fitting degree to the sample. Select the variables contained in the model for further modeling.

Table 2: Summary of stepwise regression model.

model	R	R^2	adjustment R^2	Error in standard estimation
1	0.976	0.953	0.951	2413409.088
2	0.984	0.968	0.965	2043273.036
3	0.989	0.977	0.974	1759155.857
4	0.991	0.982	0.979	1590190.015
5	0.996	0.993	0.991	1033652.563

5. Quantitative empirical analysis on the influencing factors of tax revenue in Sichuan Province

5.1. Establishment of multiple regression model of influencing factors of tax revenue in Sichuan Province

After screening the index system through stepwise regression, it is decided to take the tax revenue (y) of Sichuan Province as the explanatory variable, the added value of secondary industry (x_4), the volume of import and export trade (x_6), the per capita disposable income of Urban Households (x_7), the per capita disposable income of Rural Households (x_8), the internal expenditure of R&D funds for high-tech industries (x_9), and other factors such as money supply Policy factors are random disturbances. Based on the above analysis, the multiple linear regression equation is preliminarily established:

$$y = \beta_4 x_4 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 - \beta_9 x_9 + \mu \quad (1)$$

Multiple regression shows that the coefficient of per capita disposable income of urban households is unrealistic and does not comply with the economic significance test. Considering that the p value of its significance test fails to pass the test at the significance level of 0.01, the per capita disposable income of urban households is excluded for re modeling, and the following results are obtained:

$$y = 2089.191x_4 + 2.301x_6 + 938.139x_7 + 1424.617x_8 - 15.684x_9 + 1615202.675 \quad (2)$$

$$(t_4 = 4.451) \quad (t_6 = 6.697) \quad (t_7 = -2.688) \quad (t_8 = 5.618) \quad (t_9 = -5.323)$$

After excluding the per capita disposable income of urban households, the corresponding probability of each variable coefficient can be obtained by modeling through Stata. When the significance level is $\alpha = 0.05$, the probability of t-test coefficient is less than 0.05. According to the test results, the added value of the secondary industry, the volume of import and export trade, the per capita disposable income of rural households and the internal expenditure of R&D funds for high-tech industries have a significant impact on the tax revenue of the explained variables respectively. However, if you want to continue to analyze the application model, you must also carry out econometric test on the model to ensure the

reliability of the model results.

Table 3: Multiple regression modeling results after excluding the per capita disposable income of Urban Households.

Tax revenue (10000 yuan)	coefficient	Standard error	t	P value	confidence interval	
x_4	976.8532	332.9572	2.93	0.008	282.3168	1671.39
x_4	2.418342	.4466708	5.41	0.000	1.486603	3.350081
x_6	1128.276	309.9168	3.64	0.002	481.8006	1774.751
x_8	-19.90883	3.043316	-6.54	0.000	-26.25708	-13.56058
_cons	-1488609	278249.6	-5.35	0.000	-2069027	-908190.1

5.2. Metrological test of model

(1) Multicollinearity test

Multicollinearity refers to the possible linear correlation between explanatory variables. Serious multicollinearity will interfere with the accuracy of statistical test results. Therefore, the variance factor expansion method is used to test the multicollinearity of the model. The final Vif = 34, between 10 and 100, there is no serious collinearity, but the model may have multicollinearity. Combined with the independent variables in the model, it is very significant and has normal economic significance, so it will not be handled.

(2) Autocorrelation test

When the autocorrelation problem occurs in the model, the estimation results calculated by OLS method may no longer be valid and the statistical test results are no longer reliable. BG is used to test whether there is autocorrelation problem in the model. The Stata operation results show that there is no autocorrelation problem at the significance level of 0.05.

Table 4: Autocorrelation test results.

Lag order	χ^2	Freedom	P value
1	0.024	1	0.8777

(3) Heteroscedasticity test

If there is heteroscedasticity, the variance of the parameter estimation formula is no longer valid. Here, BP test is used to test the possible heteroscedasticity problems in the model, which will seriously destroy the effectiveness of t test and F test. Here, BG test is used to test the possible heteroscedasticity problems in the model. Original hypothesis H0 has no heteroscedasticity. According to Stata, under the significance level of 0.05, the corresponding probability is 0.1035 > 0.05. Therefore, the original hypothesis is accepted and there is no Heteroscedasticity in the model.

Table 5: Heteroscedasticity test results.

Variable	Value
chi2(1)	2.65
Prob > chi2	0.1035

5.3. Result analysis

Therefore, the final model estimates the results and obtains the regression equation:

$$y = 976.8532x_4 + 2.418342x_6 + 1128.276x_8 - 19.90883x_9 - 1488609 \quad (3)$$

This paper establishes a regression model to test the data of Sichuan Province. The experimental results show that there is a correlation between the per capita net income of rural households, the added value of the secondary industry, the internal expenditure of R&D funds for high-tech industries, the total amount of import and export and tax revenue. From the economic point of view, Sichuan's tax revenue has a positive correlation with, the added value of the secondary industry, and the total import and export volume, but a negative correlation with the internal expenditure of R&D funds of high-tech industries

reflecting the degree of innovation; From the perspective of resident level, there is a positive correlation between tax revenue and per capita net income of rural residents in Sichuan Province.

Using the estimated tax revenue model, we can predict the future development and change of tax revenue in Sichuan Province through the prediction data of "per capita net income of rural households, added value of secondary industry, internal expenditure of R&D funds for high-tech industries and total import and export", so as to effectively adjust the tax policy and make the tax level within a reasonable range.

6. Policy recommendations

6.1. Optimize the industrial structure and promote the development of the secondary industry

From the above research results, we find that from the perspective of industrial structure, the secondary industry in Sichuan Province is an important contribution to tax revenue. Therefore, we should pay attention to the development of the secondary industry, cultivate modern emerging industries and transform and upgrade traditional industries. Although we can see from the data over the years that the added value of the secondary industry is rising, there is still room for further improvement in the future. In order to promote the stable growth of tax revenue in the future. In addition, the upgrading of industrial structure will not only directly drive the tax growth, but also promote the sustained and stable economic growth, so as to indirectly promote the increase of tax revenue.

6.2. Improve the efficiency of R&D investment

The empirical analysis results show that there is a negative correlation between R & D investment and tax revenue of high-tech industries in Sichuan Province, indicating that enterprise R & D investment has not fully achieved the purpose of promoting enterprise performance, which is reflected in the fact that tax revenue has not increased. Therefore, high-tech enterprises in Sichuan Province should focus on the input-output efficiency of R & D investment, and the regulatory authorities should supervise the implementation of R & D expenses to avoid tax avoidance motivation caused by tax preference of R & D expenses.

6.3. Strengthen the reform of tax collection and management and build a new model of tax collection and management

Due to the different degree of impact of the epidemic in various provinces and cities, it is first necessary to implement classified and hierarchical management. Governments at all levels shall, according to the local economic development, the degree of economic impact, the distribution of tax sources and the situation of tax collection and management personnel, give full consideration to the industry, tax types and economic recovery, so as to realize the specialized and scientific management of tax sources. Secondly, we should improve the ability to use information technology, establish and improve the information system of tax collection and management using technology, standardize the collection and storage of tax related information, and improve the efficiency and quality of tax management. Finally, improve the quality of tax collection and management staff, give play to the incentive and guiding role of salary and welfare for staff, increase the skill training for relevant personnel, ensure the transparency and standardization of tax collection process, and build an efficient tax collection and management system.

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