Analysis of the Factors Affecting Tax in China

Yu Liu
Anhui University of Finance and Economics, Bengbu, Anhui, 233000, China

Abstract
Economy decides taxation, which in turn acts on economy. Tax revenue is the main source of China's fiscal revenue, is the foundation of a country's development, it provides a solid foundation for China's active fiscal policy. Therefore, the influencing factors of tax revenue is an important topic in the field of economic research. In this paper, considering the impact of the tax system reform on China's tax revenue in 1995 and the impact of price changes on tax revenue, the introduction of virtual variables and the adjustment of the price index of the data are analyzed. In the case of a given confidence level of 0.05, this paper mainly analyzes the influencing factors of historical data on tax from 1980 to 2020 by Eviews software, and obtains the corresponding conclusions.

Keywords
Tax Revenue; Eviews; Economy; Tax Reform.

1. Research Background
China's economic scale has an immeasurable effect on the world, and China's growing development is inseparable from tax revenue. Tax revenue is the main economic source of a government. In 2020, the total scale of China's economy reached 10159.862 billion yuan, due to the impact of the epidemic, the national general public budget revenue was 18289.5 billion yuan, a decrease of 3.9%. Tax revenue is the main source of national fiscal revenue, and the change of tax revenue is the main reason for the change of economic growth. However, the distribution of social wealth is not zero-sum game. In modern economic theory, when the tax exceeds a certain level, increasing tax rates will reduce national income [2]. Recently, China's economy has been hit hard by the new coronavirus disease. We need to recover our economy as soon as possible and reach the previous growth rate. Studying the influencing factors of tax revenue helps to accelerate the recovery of the national economy.

2. Theoretical Analysis on the Impact of Taxation
2.1. Gross Domestic Product
GDP is the total value created by economic activity in a country or region for a period of time. GDP is the total amount of capital in a country or a region for a certain period of time, and also includes the flow rate of this capital. The faster the speed is, the higher the GDP is. On the contrary, the lower.

2.2. National Fiscal Expenditure
Fiscal expenditure refers to the allocation and use of social resources by the government in order to perform its own functions. The greater the government's fiscal expenditure, the more the government needs funds to support its huge fiscal expenditure, and tax revenue is the main fiscal revenue. In order to ensure its normal operation, if the government has a large fiscal expenditure, it will increase tax revenue to ensure fiscal surplus.
2.3. Consumer Price Index
Consumer price index is an indicator that reflects the price changes of goods and services related to residents' daily life, which directly affects the promulgation of national macroeconomic regulation and control policies. In general, the higher the consumer price index, the higher the national tax revenue.

2.4. Total Import and Export
Commodities generally need to pay tariffs when entering and leaving the customs. However, the larger the total import and export volume is, the more tariffs will be, and the national tax revenue will change.

2.5. Total Fixed Asset Investment of the Whole Society
Tax growth comes from economic development, fixed asset investment is the driving force to promote economic development, has an important impact on economic development. There is a cointegration relationship between tax revenue and fixed asset investment, and they have a long-term equilibrium relationship. At the same time, tax revenue is an important means to improve national economic development. Fixed total investment plays a decisive role in total investment and also plays an important role in improving economic growth. Therefore, fixed asset investment has an impact on tax revenue.

2.6. Virtual Variables
After 30 years of economic system reform, China’s tax system has also undergone tremendous changes[3]. Tax reform also has a significant impact on China’s tax revenue, considering that the reform of the national tax system in 1995 may have an impact on tax revenue, so the tax reform is introduced as a virtual variable. Setting $D1 = 0$ before 1995 shows that the tax system has not changed greatly, and $D1 = 1$ after 1995 shows that the tax system has changed greatly.

3. Data Collection
Through the National Bureau of Statistics, this paper collects and sorts out the data of national tax revenue ($Y$), gross domestic product ($X1$), fiscal expenditure ($X2$), CPI ($X3$), total import and export ($X4$), total fixed asset investment ($X5$) of the whole society from 1980 to 2020.

4. Model Construction
4.1. Setting Variables
In order to analyze the impact of GDP, national fiscal expenditure, CPI and total import and export on national tax revenue, national tax revenue is selected as the explained variable, and GDP, national fiscal expenditure, consumer price index, total import and export, total investment in fixed assets of the whole society are selected as the explanatory variables.

4.2. Data Analysis
4.2.1. Mapping of Trends
According to the collected data, it can be seen that the data except the consumer price index show an overall upward trend. We can see more clearly that there is a certain correlation between the explanatory variables and the explained variables through the trend diagram of eviews software.

4.2.2. Drawing Relevant Figures
By observing the correlation diagram between each explanatory variable and the explained variable, it can be seen that there is a clear linear relationship between the national tax revenue of the explained variable and the GDP of the explanatory variable, between the explanatory
variable and the national fiscal expenditure, between the explanatory variable and the consumer price index, between the explanatory variable and the total import and export volume, and between the explanatory variable and the total investment in fixed assets of the whole society.

Because there is a high linear correlation between the country’s tax revenue $Y$ and each explanatory variable, the above variables and other uncertain factors affecting tax revenue are used as random perturbations to establish a multivariate linear regression model: $Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \mu_i$

5. Parameter Estimation

Ordinary least squares estimation of data based on the above model. The results are shown in the figure.

![Figure 1. Regression results](image)

The results of model estimation are as follows:

$$Y = 1921.9540 - 0.0731X_1 + 0.3224X_2 - 9.3828X_3 + 0.1578X_4 + 0.1997X_5$$

$$(7661.7790) (0.0305) (0.1678) (71.1975) (0.0210) (0.0488)$$

$t=(0.2509) (-2.3951) (1.9218) (-0.1318) (7.5145) (4.0925)$

$$R^2 = 0.9982 \quad \bar{R}^2 = 0.9979 \quad F = 3833.7420 \quad n = 41 \quad DW = 0.8199$$

It can be seen that 99.82% of the total deviation of the observed value of national tax revenue in the explanatory variable of this model is explained by the estimated sample regression model. The goodness of fit of the model is high, and the F test of the model is significant at a given significance level of 0.05, but the t test of the partial regression coefficients of the explanatory variables of national fiscal expenditure and consumer price index is not significant, so the model may have multiple collinearity.

Considering that the consumer price index has a relevant impact on all data, the consumer price index is used to adjust the price index of all variables to generate a new quaternion equation. Let us conduct the least squares estimation of the new data.
Figure 2. Regression results after price index adjustment

The model estimation results are as follows:

\[
YS = 8.3440 - 0.0695X_{S1} + 0.3056X_{S2} + 0.1559X_{S3} + 0.2020X_{S4}
\]

\[
(6.3550) (0.0302) (0.1672) (0.0210) (0.0484)
\]

\[
t = (1.3130) (-2.2997) (1.8279) (7.4394) (4.1721)
\]

\[
R^2 = 0.9982 \quad \bar{R}^2 = 0.9980 \quad F = 4942.6370 \quad n = 41 \quad DW = 0.8161
\]

6. Model Checking and Correction

6.1. Economic Significance Test

According to the regression equation estimation results, the actual national fiscal expenditure, the actual total import and export are positively correlated with the actual total investment in fixed assets of the whole society and the actual national tax revenue, which is consistent with the theory. The actual GDP is negatively correlated with the actual national tax revenue, indicating that the actual GDP increases and the national tax revenue decreases, which is contrary to the theory. It can be inferred that the model has problems and needs to be modified.

6.2. Statistical Inference Test

6.2.1. Test of Goodness of Fit

According to the estimated sample regression model data, the coefficient of determination of the model is 0.9982, and 99.82% of the total variation of the observed value of the actual national tax revenue is explained by the estimated sample regression model, indicating that the model has high goodness of fit for the sample data.

6.2.2. T Test

For the original hypothesis \( H_0: \beta_j = 0 (j = 1, 2, 3, 4) \), alternative hypothesis \( H_1: \beta_j \neq 0 (j = 1, 2, 3, 4) \), given the significance level is equal to 0.05, check the degree of freedom of 36 t distribution table, get the critical value \( 2.102 < t_{0.025(36)} < 2.042 \).

By comparing the absolute value and critical value of t statistics of partial regression coefficients of each explanatory variable, it is concluded that when other explanatory variables remain unchanged, the actual gross domestic product, the actual total import and export, and the actual investment in fixed assets of the whole society have a significant impact on the explanatory variable, while the actual national fiscal expenditure has no significant impact on the explanatory variable.
6.2.3. F-test

According to the original hypothesis $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$, given the significance level of 0.05, the value of $F$ statistics is 4942.6370, Prob ( F-statistic ) = 0.0000. Since Prob ( F-statistic ) <0.05, the original hypothesis is rejected, indicating that the regression equation is significant, that is, the actual GDP, the actual national fiscal expenditure, the actual total import and export volume XS3 and the actual total investment in fixed assets of the whole society are the four explanatory variables that are jointly significant to the national tax revenue of the explained variable. The model passes the F test.

6.3. Econometric Test

6.3.1. Multicollinearity Test and Correction

From the above test, it is found that the positive and negative signals of the partial regression coefficient of the actual GDP are inconsistent with the theoretical results. The model has a high coefficient of determination, and the F test is significant. However, the t test of the partial regression coefficient of the actual national fiscal expenditure is not significant, which can be judged that the model is likely to have multiple collinearity.

Variance expansion factor test method. Different auxiliary regression equations are constructed, and the variance expansion factor of each auxiliary regression model is determined by the determination coefficient of the auxiliary regression equation. The results are as follows:

<table>
<thead>
<tr>
<th>MODEL</th>
<th>VIF</th>
<th>TOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>XS1=f(XS2,XS3,XS4)</td>
<td>608.6729</td>
<td>0.0011</td>
</tr>
<tr>
<td>XS2=f(XS1,XS3,XS4)</td>
<td>1136.7020</td>
<td>0.0006</td>
</tr>
<tr>
<td>XS3=f(XS1,XS2,XS4)</td>
<td>22.8505</td>
<td>0.0264</td>
</tr>
<tr>
<td>XS4=f(XS1,XS2,XS3)</td>
<td>393.4343</td>
<td>0.0021</td>
</tr>
</tbody>
</table>

The above table shows that the variance expansion factor is greater than 10 and the tolerance is less than 0.1, indicating that there is a serious multicollinearity between explanatory variables.

Correction of multicollinearity. Due to the stepwise regression method of eviews software, the judgment of the model is only through statistical inference test, while ignoring the economic significance test, so the manual stepwise regression method is used to test the economic significance and statistical inference of each model.

Establishment of one-variable basic linear regression equation. It can be seen from the correlation coefficient diagram that the correlation coefficient between the actual national tax revenue and the actual total fixed investment of the whole society is the largest. Therefore, we first establish a basic linear regression equation between the actual national tax revenue and the actual total fixed investment of the whole society. The regression results show that the actual total fixed asset investment of the explanatory variable is positively correlated with the explained variable, which is consistent with the theory. The t-test of explanatory variables for the total investment in fixed assets of the whole society was passed at a significant level of 0.05, and the revised coefficient of determination was 0.9930.

Other explanatory variables are gradually introduced. Based on the above univariate basic linear regression model, the remaining explanatory variables are introduced to estimate the binary linear regression model. When the actual gross domestic product is introduced, the partial regression coefficient between the actual gross domestic product and the actual fixed asset investment of the whole society is greater than 0, and the economic significance is reasonable. The introduction of the actual GDP does not affect the t-test of the actual fixed asset
investment of the whole society. The coefficient of determination of the model correction is 0.9937, which is better than the previous one-variable basic linear regression equation. When the actual national fiscal expenditure is introduced, the partial regression coefficient of the explanatory variable is less than 0, and the partial regression coefficient of the actual fixed asset investment of the whole society is greater than 0, which is contrary to the theory. When the actual total import and export volume is introduced, the partial regression coefficients between the actual total import and export volume of the explanatory variable and the actual fixed asset investment of the whole society are greater than 0, and the economic significance is reasonable. The introduction of the actual total import and export does not affect the t-test of the actual fixed asset investment of the whole society. The coefficient of determination of the model correction is 0.9978, which is better than the previous one-variable basic linear regression equation. Through the above analysis, it can be found that when the actual GDP is introduced, the model ’ s modified coefficient of determination is not improved compared with the original model. When the total import and export volume is introduced, the model ’ s modified coefficient of determination is improved compared with the original model. So retain the actual total import and export. Therefore, the estimated results of YS = f ( XS4, XS3 ) are the optimal binary regression model. On this basis, a ternary regression model is established.

When the actual GDP is introduced, the partial regression coefficient of the explanatory variable is less than 0, which is not in line with economic theory, and the t test is not passed. When the actual national fiscal expenditure is introduced, the partial regression coefficient of the explanatory variable is less than 0, which is not in line with economic theory, and the t test is not passed.

Through the above analysis, the modified model is:

\[
YS = 0.0565 + 0.1172XS3 + 0.2372XS4
\]

\[
(5.4580) \quad (0.0127) \quad (0.0082)
\]

\[
t = \begin{pmatrix} 
0.0104 & 9.2575 & 28.8362
\end{pmatrix}
\]

\[
R^2 = 0.9979 \quad \bar{R}^2 = 0.9978 \quad F = 9094.1830 \quad DW = 0.7177
\]

The economic significance of this model is reasonable, and the coefficient of determination is 0.9979, indicating that 99.79 % of the total deviation of the actual national tax revenue observations of the explained variable is explained by the estimated model. The goodness of fit of the model is very high. F test and t test of all partial regression coefficients are significant. The model estimation results show that the actual national tax revenue is mainly determined by the actual total import and export and the actual total investment in fixed assets of the whole society. When other factors remain unchanged, the actual national tax revenue increases by CNY 0.1172 on average for every CNY 1 increase in the actual total import and export. The actual total investment in fixed assets of the whole society increased by 1 yuan, the actual national tax revenue increased by 0.2372 yuan on average. After modifying the multicollinearity of the model, taking into account whether the tax reform in 1995 has an impact on tax revenue, the dummy variable is introduced in the general form. Before 1995, the dummy variable is 0, indicating that the tax system has not changed greatly. After 1995, the dummy variable is 1, indicating that the tax system has changed greatly. The regression results are:

\[
YS = 8.6305 + 0.0922XS3 + 0.1729XS4 - 20.2052D1 + 0.0372(XS3 \times D1) + 0.0593(XS4 \times D1)
\]

\[
tagenary = \begin{pmatrix} 
0.8052 & 0.1335 & 0.2151 & -1.3707 & 0.0539 & 0.0737
\end{pmatrix}
\]
After the introduction of virtual variables, the partial regression coefficient of the explanatory variable of the original reasonable regression equation becomes not significant, and the P value of the partial regression coefficient of the virtual variable is greater than 0.05, indicating that the virtual variable is not significant, indicating that the implementation of the tax system has no effect on China’s tax revenue, and there is no segmentation problem between tax revenue from 1980 to 2020, so the model eliminates the virtual variable.

6.3.2. Self-correlation Tests and Amendments

If there is autocorrelation in the model, the standard error will be reduced, and the t-statistic value of the partial regression coefficient of the model will be increased, which may make the explanatory variables that are not significant become significant. It violates the classical assumption - no autocorrelation assumption, so that the parameter results of ordinary least squares estimation are no longer effective.

Partial regression coefficient test. Observing the crosswalks, the first and second order crosswalks exceed the imaginary line, indicating that the first and second order autocorrelation may exist in the model.

![Figure 3. Partial regression coefficient diagram](image)

BG test. Select the lag period of 2, the result is $nR^2 = 14.9818, \chi^2(2) = 5.99147, nR^2 > \chi^2(2)$, indicating that there is a first-order and second-order autocorrelation in the model. Select the lag period of 3, $nR^2 = 26.3561, \chi^2(3) = 7.81473, nR^2 > \chi^2(3)$, The p value of the t test of the first-order and second-order autocorrelation partial regression coefficients is less than 0.05, but the t test of the third-order autocorrelation partial regression coefficients is not passed.

In summary, it can be seen that the model has first-order and second-order autocorrelation. The Self-correlation of the model is corrected by the GLS-Corklin-Ockett method. According to the regression results of the generalized least squares method, it can be seen from the figure that the estimation process of the model has experienced seven iterations and convergence, and then the BG test is carried out on the model. According to the BG test results, the p value of the Lagrange multiplier is greater than 0.05, indicating that there is no autocorrelation in the modified model.

So the final model is:

$$YS = -3.6438 + 0.1488XS3 + 0.2128XS4 [AR(1) = 1.4164 AR(2) = -0.7946]$$

(8.5172)  (0.0158)  (0.0116)
Model estimation shows that when other explanatory variables remain unchanged, the actual total import and export increases by 1 yuan, the actual national tax revenue increases by 0.1488 yuan on average, the actual total investment in fixed assets increases by 1 yuan, the actual national tax revenue increases by 0.2128 yuan on average.

Using the estimated tax revenue model, we can predict the development and change of China’s future ‘tax revenue’ by using the estimated data of ‘total investment in fixed assets’ and ‘total import and export’.

7. Conclusions and Suggestions

By using econometric model and empirical analysis, it is concluded that China’s tax revenue is significantly affected by the total amount of real fixed assets and the total amount of real import and export, and the partial regression coefficient between tax revenue and the total amount of real fixed asset investment is larger, indicating that the correlation between tax revenue and the total amount of fixed asset investment is more significant. In the model, the actual gross national product and actual fiscal expenditure have little influence on tax revenue. However, according to the results of empirical analysis, relevant literature and practical experience, it can be seen that the above factors do not have any actual influence on tax revenue, but need further research and discussion. Finally, according to the above empirical analysis conclusions, the following recommendations are made.

7.1. In-depth Economic Sustainable Development and Revision of Relevant National Policies

With the sustained and rapid development of China’s economy, we should actively develop appropriate sustainable development mechanisms to adapt to the current economic changes. Especially after the new corona pneumonia epidemic in China, China is now in the post-epidemic economy. It is necessary to establish a tax system with low tax rate, wide tax base and strict collection and management, so as to lay a solid foundation for us to overcome the economic turmoil of the epidemic.

7.2. Pay Attention to National Import and Export Management and Formulate Reasonable Tax Policies

The actual total amount of import and export has an important impact on national tax revenue, so the state should strengthen the management of import and export, in accordance with national policies, intentionally control the import and export of commodities, so as to increase national tax revenue, promote national economic growth, improve our national life satisfaction, reduce the contradiction between the growing needs of our people for a better life and unbalanced and inadequate development, in order to help achieve the ultimate goal of our party.

7.3. Paying More Attention to Fixed Asset Investment and Improving the Existing Financial Market

Strengthen the control of social investment in fixed assets, play a leading role in economic growth and national strength development. Improve the daily control of fixed capital, according to the relevant national policies and regional development advantages strategy, actively promote the investment and construction of key projects, pay attention to the quality management of social investment investment in fixed capital. At the same time, it is necessary to improve the existing financial market. China’s current financial market is still developing in depth. By enriching people’s investment channels, broadening investment paths, promoting
national investment and increasing the total investment in fixed assets, China’s stock market will be improved and China’s economic development will be improved.

References

