

Exploring the Factors Affecting China's GDP Based on Multiple Regression Expenditure Method

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Abstract: This paper mainly uses the econometric analysis method to collect the national GDP data from 1990 to 2020 in the statistical yearbook, establish a multiple regression model, and estimate, test and apply the parameters of the model to explore the factors affecting China's GDP under the expenditure method, and give relevant GDP development suggestions based on the conclusions.

Key words: Expenditure Accounting; National GDP; Influencing Factors; Multiple Regression Model

Introduction

GDP, also known as gross domestic product, is the market value of all final products (goods and services) produced by a country (or a region) in a certain period of time by using production factors. It is the core index of national economic accounting and an important index to measure the economic situation and development level of a country or region. ^[1] According to the relevant formula of calculating GDP under the expenditure method, combined with some previous studies of scholars, this paper takes consumption expenditure, investment expenditure, government purchases, net exports and urban employment as the relevant variables affecting GDP, and conducts multiple regression analysis through Eviews9 software to explore the final results.

1. Literature review

Because GDP can accurately reflect a country's economic strength through data, many domestic researchers are keen to study the factors affecting GDP. For example, some scholars believe that the consumption level of residents, total import and export trade, foreign direct investment, energy consumption, total retail sales of social consumer goods, financial expenditure, employment, R & D expenditure are the main factors affecting GDP ^[2]. Some scholars believe that income, consumption level, total import and export trade ^[3], foreign direct investment and research and experimental development expenditure ^[4], fixed asset investment and employment are the main factors affecting GDP ^[5].

2. Econometric models and estimation methods

2.1 Description of the model

2.1.1 Analysis of influencing factors

Using the expenditure method to calculate the GDP of the whole country is to calculate the total expenditure of the whole society to purchase the final products in a certain period of time.

Theoretical basis: the total value of the final product = the total expenditure of a society to purchase the final product

GDP calculation formula of expenditure method: $GDP = \text{consumption expenditure} + \text{investment expenditure} + \text{government purchase expenditure} + \text{net export}$

$$GDP=C+I+G+(X-M)$$

Therefore, this paper holds that the main factors affecting GDP are as follows:

2.1.1.1 Consumption expenditure

Consumption expenditure includes the purchase of non-product expenditure, such as the purchase of stocks, securities, etc., as well as the purchase of product expenditure, such as durable consumer goods, services, etc. Expenditure on residential construction is not included.

2.1.1.2 Investment expenditure

Investment expenditure includes fixed investment and inventory investment. Fixed investment includes the increase of new factory buildings, new commercial buildings, new residential buildings and new machinery and equipment. It is worth noting that fixed investment under the expenditure method also includes depreciation.

2.1.1.3 Government purchase

Government purchase refers to the purchase of products and services by governments at all levels, including the purchase of consumer goods and capital goods.

2.1.1.4 Net export

Net exports is the difference between a country's exports and its imports. The country's foreign trade surplus shows that the export volume is greater than the import volume, and the increase in export volume shows that the country's product quality is in the leading position, which also reflects the development of the national economy.

2.1.1.5 Number of urban employment

Employment in cities and towns generally refers to the new employment in cities and towns, that is, the number of people who participate in the economic activities of employment and get remuneration through employment.

3. Selection of explanatory and explained variables

Based on the above analysis of the influencing factors, the selection of explanatory variables and explained variables is carried out.

Explained variable: Y: Gross national product under expenditure method (100 million yuan)

Explanatory variable: X1: household consumption (100 million yuan)

X2: Total capital formation (100 million yuan)

X3: Government consumption (100 million yuan)

X4: Net exports of goods and services (100 million yuan)

X5: Urban employed population (10,000 persons)

4. Model form and reason of setting

Based on the accounting formula of the national economy under the expenditure method, we establish the following regression model

$$Y = \alpha + \beta X_1 + \gamma X_2 + \delta X_3 + \theta X_4 + \varphi X_5 + \epsilon_i$$

4.1 A description of the method of inference

First, establish the multiple linear regression model, input the data, use Eviews software to estimate the parameters, and then test the model, mainly divided into three parts of the test: economic test, statistical test and econometric test. Whether the model is correct or not is judged by testing whether the model has multicollinearity, heteroscedasticity and autocorrelation, and the above problems still exist and need to be corrected by using specific methods. Finally, we will apply the tested model to solve our practical problems.

4.2 Data processing and result analysis

4.2.1 Data source and summary

Search relevant data in China Statistical Data Application Support System, classify and search according to the requirements of various indicators, complete the data collection of gross national product, household consumption, total capital formation, government

consumption, net export of goods and services of the 31 samples from 1990 to 2020 under the expenditure method, and summarize them into the following table.

4.2.2 Processing of data

4.2.2.1 Model setting

According to the collected data, Eviews software was used to establish the multiple linear regression model.

4.2.2.2 Parameter estimation

The following results of parameter estimation and test are obtained:

$$Y = -16.2590 + 1.0228X_1 + 1.0475X_2 + 0.8007X_3 + 0.9685X_4 + 0.1957X_5$$

$$T(-0.0158) (8.0023) (35.2686) (2.8257) (20.6653) (0.1317)$$

$$R^2 = 1.0000 \quad N = 31 \quad F = 1318729.3 \quad DW = 1.3496$$

5. Model checking

5.1 Economic significance test

From the above analysis of each explanatory variable, we can see that consumption expenditure, investment expenditure, government expenditure, net exports and urban employment population should have a positive impact on GDP. That is to say, under the expenditure method, the coefficients of the above explanatory variables are all positive, otherwise it violates the assumption of GDP accounting in the expenditure method. The coefficients before each explanatory variable are greater than 0, so the economic test of the regression model passes.

5.2 Statistical test

In order to compare the goodness of fit of models with different numbers of explanatory variables, we introduce the modified coefficient of determination, and find that the modified coefficient of determination is still 1.000 in the model, which has good fitness and passes the goodness of fit test.

5.2.1 Significance test of variables

Under the condition of the given significance level $\alpha = 0.05$, it is found that the T statistic value of the regression model is larger, and the four explanatory variables of consumption expenditure, investment expenditure, government expenditure and net export pass the significance test, but the explanatory variables of government consumption and urban employment population have no significant impact on GDP, and the T test fails.

5.2.2 Significance test of the model

In the F test, the F statistic of the model is 1318729.3. The F test passes, which shows that the five explanatory variables of household consumption, total capital formation, government consumption, net exports of goods and services and urban employment population have a significant impact on the national GDP.

5.3 Econometric test

5.3.1 Multicollinearity test

In the above T test, we find that the explanatory variables of government consumption and urban employment population have no significant impact on GDP (explanatory variable), but the goodness of fit is good, so we preliminarily judge that the model may have multicollinearity.

The existence of multicollinearity of the model was further judged by variance inflation factor test. According to the modeling, only the variance inflation factor of net export is less than 10, while the variance inflation factors of other explanatory variables are far greater than 10, which indicates that there is a serious multicollinearity among the explanatory variables of household consumption (X1), total capital formation (X2), government consumption (X3) and urban employment population (X5).

The model after multicollinearity correction is easily obtained by the stepwise regression method:

$$Y=73.6086+1.0350X1+1.04735X2+0.7858X3+0.9678X4$$

Dependent Variable: Y
 Method: Least Squares
 Date: 12/07/22 Time: 00:06
 Sample: 1990 2020
 Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	73.60861	758.7601	0.097012	0.9235
X3	0.785765	0.254748	3.084476	0.0048
X2	1.047352	0.029100	35.99204	0.0000
X4	0.967785	0.045700	21.17714	0.0000
X1	1.034983	0.086553	11.95778	0.0000

R-squared	0.999984	Mean dependent var	334649.3
Adjusted R-squared	0.999982	S.D. dependent var	319369.7
S.E. of regression	1359.217	Akaike info criterion	17.41390
Sum squared resid	48034244	Schwarz criterion	17.64518
Log likelihood	-264.9154	Hannan-Quinn criter.	17.48929
F-statistic	414060.9	Durbin-Watson stat	1.366438
Prob(F-statistic)	0.000000		

5.3.2 Heteroscedasticity

5.3.2.1 White test

It is found that under the condition of significance level = 0.05, $0.052(14) = 23.685 > 212.29530$, and then observe the size of the accompanying probability p value, it is found that the p value is greater than 0.05, so based on the above two judgments, there is no heteroscedasticity in the model.

5.3.3 Autocorrelation

5.3.3.1 Partial Correlation Coefficient Test

The figure below shows the partial correlation coefficient test of the regression model. Observing the figure below, it is found that there is no autocorrelation in the first 16 orders of autocorrelation test.

Date: 12/07/22 Time: 00:53
 Sample: 1990 2020
 Included observations: 31

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
1		-0.038	-0.038	0.0488	0.825
2		-0.020	-0.022	0.0635	0.969
3		-0.079	-0.081	0.2925	0.961
4		-0.150	-0.158	1.1419	0.888
5		-0.202	-0.228	2.7474	0.739
6		-0.023	-0.074	2.7683	0.837
7		-0.037	-0.096	2.8256	0.901
8		-0.043	-0.138	2.9070	0.940
9		0.045	-0.071	3.0020	0.964
10		0.093	-0.001	3.4276	0.969
11		0.055	-0.001	3.5850	0.981
12		-0.024	-0.083	3.6166	0.989
13		-0.053	-0.108	3.7771	0.993
14		-0.036	-0.058	3.8562	0.996
15		0.012	0.003	3.8661	0.998
16		0.079	0.061	4.2890	0.998

6. Model application

The original multiple linear regression model was tested by economic significance test, goodness of fit test, T test, F test, Test for heteroscedasticity, and modify the case of multicollinearity and autocorrelation, and finally get The multiple regression model of the factors affecting GDP under the expenditure method is as follows:

$$= 73.6086 + .0350 + .474 + 0.7858 + 0.9678 + \varepsilon_i$$

Conclusion

According to the level of China's economic development, through the relevant data from 1990 to 2020, we can see that consumption expenditure, investment expenditure, payment for purchases and net exports have a greater impact on GDP, while the total number of urban employment population, which seems to affect GDP, actually has little impact on GDP. Therefore, the GDP accounting formula under the expenditure method is very effective in calculating China's GDP. Through the multiple regression model of the final factors affecting GDP, we can find that the main factors affecting China's GDP are consumption expenditure, investment expenditure, payment for purchases and net exports.

References

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