

# An empirical study on the main factors of China's economic growth

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**Abstract.** Although China has made great achievements in the economy in the past few decades, there is still a lot of room for growth in the next 30 years, and there is a long way to go to transform theoretical growth into real growth. This paper selects the relevant data of China's GDP, consumption, fixed asset investment, exports, employment and so on from 1998 to 2019, and carries out multiple regression through Eviews software, so as to make an empirical analysis of the factors affecting China's economic growth. The empirical results show that investment in fixed assets, consumption, exports and employment all promote economic growth.

**Keywords:** Economic Growth, Multiple Regression Model, Influence Factors, Empirical Analysis.

## 1. Introduction

### 1.1 Research background

After the 2008 financial crisis, the growth of the world economy slowed down significantly, and even some countries fell into recession, with negative economic growth, accompanied by large-scale unemployment and social unrest. In 2020, COVID-19 was rampant around the world. China was the first country where the COVID-19 epidemic began to break out on a large scale. China's economy suffered a serious impact, especially in Hubei Province, the center of the epidemic. Affected by the epidemic, the demand and supply have decreased sharply in the short term, resulting in a 14.3% decline in China's manufacturing PMI index in February 2020 compared with January, and a 24.5% decline in the non manufacturing business activity index compared with January, including a significant decline in the demand of consumer industries such as transportation, tourism, accommodation and catering, and residential services. This has brought great fluctuations to China's macro and micro economy. During the two sessions in 2021, the state pointed out that at present, China's economy is in the new economic normal of "superposition of three periods", and at this stage, China's economy is facing unprecedented challenges. As the largest developing country in the world, China's living standard will be improved and the society will be more stable and harmonious only when the economy continues to grow steadily. Therefore, studying how to promote China's economic growth is a key and difficult point facing China at present.

As we all know, consumption, investment and export are the troika of economic development. As the main driving force of economic operation, consumption plays a very important role in stimulating economic growth. On the one hand, consumption is a component of GDP, and the growth of consumption is directly the growth of GDP; On the other hand, consumption, as an initial variable, drives investment and export, which in turn drives economic growth. Investment can increase demand and stimulate economic growth in the short term; In the long run, it can form a certain productivity, increase the production capacity of social products, improve commodity supply, and promote economic growth. Therefore, investment has both supply and demand effects on economic growth. It is not only the main driving force of economic growth, but also the most important factor inducing economic fluctuations. It has a "double-edged sword" effect. "Foreign trade is the engine of economic growth". Exports have a positive impact on economic growth. The growth of exports will directly lead to the increase of domestic effective demand, which is conducive to a country's accumulation of necessary foreign exchange funds and the import of foreign capital and technology, so as to improve production capacity. In addition, the increase of exports improves the production efficiency of enterprises and stimulates entrepreneurship. Through the spillover benefits of technology and

knowledge, it can promote technological innovation and progress, improve product quality, enable a country to further participate in the international division of labor, and obtain the benefits of external economies of scale.

On the other hand, there are many connections between economic growth and employment. Analyzing the influencing factors of the relationship between them plays a vital role in the healthy development of our economy. Theoretically, China's economic growth can bring more employment, and the increase in the number of employment can also make the economy grow faster. In the development process of our country, the employment problem has always been concerned. The employment problem is related to the people's livelihood. The high unemployment rate will cause serious social problems. In the central document of 2018, the central government clearly regarded employment as the first of the "six stabilities". In the report of the 19th CPC National Congress, General Secretary Xi pointed out that we should give priority to stabilizing employment and take it as the priority of macro policies to achieve higher quality and more stable employment. According to the statistics of the Bureau of statistics, the urban unemployment rate of China was 2.6% in 2019, which is relatively low, but the research on unemployment can not be ignored. Generally speaking, economic growth is the basis for improving the employment rate, and economic growth can also bring about the improvement of the employment rate.

For the above factors: consumption, investment, export and employment, this paper selects the total retail sales of social consumer goods to represent consumption, the total investment in fixed assets to represent investment, the total export to represent exports, and the number of employees to represent employment. The gross domestic product ( $Y$ ) is taken as the measurement index of China's economic growth, and the total retail sales of social consumer goods ( $X_1$ ), total investment in fixed assets ( $X_2$ ), total exports ( $X_3$ ) and employment ( $X_4$ ) are taken as independent variables. Based on the statistical data from 1997 to 2019, this paper makes an empirical analysis on the main influencing factors of China's economy by using the analysis method of multiple regression.

## 1.2 Literature Review

### 1.2.1 Consumption demand

Under the background of highly planned economy, the role of consumer demand in promoting social production has been greatly restricted. In the context of open market economy, the demand-oriented economy has gradually replaced the supply-oriented economy, and consumer demand is the key factor of market demand. Wang [1] pointed out that the role of consumer demand in economic growth has gradually changed, and the role of demand has gradually deepened. From first relying on supply to later relying on investment, it has become the main driving force for economic growth. Su and Zhao [2] used econometric models to analyze the relationship between China's GDP, investment, consumption and import and export trade.

The results show that China's consumption output elasticity is much higher than investment elasticity, and expanding domestic demand is an effective way to promote economic development. Insufficient consumption is a prominent problem in the process of economic operation in our country. Therefore, many domestic scholars have conducted a lot of research on the causes of insufficient consumption, the changes of consumption structure and how to improve consumption. Zhou pointed out that the lack of domestic consumption demand is mainly the reason why residents' income lags behind GDP growth. Pan [3] studied consumer demand from the perspective of industrial structure, and the results showed that the lack of consumer demand was mainly caused by the major adjustment of industrial structure. Therefore, to improve consumer demand, it is necessary to upgrade the industrial structure to adapt to the impact of changes in consumption structure.

### 1.2.2 Investment demand

Domestic demand includes investment domestic demand and consumption domestic demand. Among the troika driving economic growth, investment is the most active. As we all know, there is a mutually promoting and restricting relationship between investment and economic growth.

Investment can increase future production capacity while forming current demand [4]. Fan [5] believes that investment is the direct cause of economic growth, and economic growth will promote the further growth of investment. Lai [6] pointed out that China is in the middle of industrialization. Although there is a certain inevitability of a large-scale investment proportion, it is already a fact that the marginal decline of investment efficiency. At this time, China's economic growth needs to seek a new way of development.

Investment and consumption are complementary. The overheated investment of the Chinese government has restrained domestic consumption. Wang [7] believes that the imbalance between consumption and investment is caused by the large proportion of investment in GDP and the unequal investment efficiency and scale. On the whole, China's economic growth is mainly driven by a large amount of investment in factors. Liu and Cai [8] compared the cost of economic growth and the composition of GDP between China and Japan, and concluded that Japan's investment rate continued to improve during the period of rapid economic growth. With the continuous strengthening of economic strength, the investment rate gradually fell from the highest point [9].

### 1.2.3 Export demand

In terms of foreign trade dependence, there are two different views in China: some scholars believe that too high foreign trade dependence will have a negative impact on the national economy; Other scholars believe that China's dependence on foreign trade is not enough to hinder economic development, and point out that this indicator is not comparable. Therefore, Wang [10] believes that the degree of dependence on foreign trade is an indicator to measure the degree of economic openness, rather than the only indicator to measure the degree of dependence on foreign trade. Jiang [11] believes that an important feature of the in-depth development of economic globalization is that the growth rate of the global economy is lower than that of international trade. Despite the twists and turns in the process of globalization, countries have set up various barriers to protect their economies to hinder imports, but on the whole, Global trade is more frequent, and their dependence on foreign trade is also rising.

However, recent research shows that domestic demand growth and external demand growth are not contradictory. There is mutual influence and promotion between the two. Dai [12] used econometric models to study China's data, which showed that there was a cointegration relationship between domestic demand and external demand, and there was a two-way causal relationship, and there was a significant interactive dynamic impact between changes in external demand and changes in domestic demand. Bao [13] believes that the relationship between domestic and foreign demand is essentially the relationship between domestic economic operation and foreign economic operation. Both of them restrict and promote each other. Foreign demand (export) can directly drive the increase of domestic consumption, investment and government expenditure [14].

The relationship between employment and economic growth has also been deeply studied in China. Yang and Zhang [15] analyzed the relationship between China's economic growth and employment through empirical analysis, and proposed that from a long-term perspective, the rise in employment has a strong role in promoting economic development, and obtained the reasons for a country's GDP increase when the employment increase through Granger causality test. Xia [16] proposed that the impact of economic development on employment has both positive and negative pulling effects. Through empirical analysis of the relationship between the two, the following results are obtained: compared with rural areas, the role of economic growth in cities and towns in stimulating employment is more obvious. In addition, from the perspective of industrial structure, the labor force in the primary industry is surplus, and the labor supply in the secondary industry is insufficient. Song [17] discussed that it is mainly wage rigidity that leads to the phenomenon of high growth and low employment in China. Due to the progress of technology, the demand for labor becomes less, which will reduce the labor supply in the short term. In the long run, technological progress has led to the expansion of economic scale and the upgrading of industrial structure, which has created many new jobs, thus driving the growth of employment. Li [18] analyzed the applicability of Okun's law in China and

pointed out that the economic growth in China is faster than the development of the employment market, so Okun's law is also applicable in China.

The above is the representative research results of domestic scholars on the composition of China's investment, consumption and export Troika and employment driven GDP.

## 2. Data collection and model setting

### 2.1 Data collection

The data of China's GDP (Y), total retail sales of social consumer goods (X<sub>1</sub>), total investment in fixed assets (X<sub>2</sub>), total exports (X<sub>3</sub>) and employment (X<sub>4</sub>) from 1997 to 2019 are shown in Table 1. The data is from China Statistical Yearbook from 1996 to 2020.

**Table 1.** China's economic indicators from 1997 to 2019

year	Y/trillion	X <sub>1</sub> /trillion	X <sub>2</sub> /trillion	X <sub>3</sub> /trillion	X <sub>4</sub> /million
1997	79715.0	31252.9	24941.0	15160.7	69820.0
1998	85195.5	33378.1	28406.0	15223.6	70637.0
1999	90564.4	35647.9	29855.0	16159.8	71394.0
2000	100280.1	39105.7	32918.0	20634.4	72085.0
2001	110863.1	43055.4	37214.0	22024.4	72797.0
2002	121717.4	48235.9	43500.0	26947.9	73280.0
2003	137422.0	52516.3	55567.0	36287.9	73736.0
2004	161840.2	59501.0	70477.0	49103.3	74264.0
2005	187318.9	67176.6	88774.0	62648.1	74647.0
2006	219438.5	76410.0	109998.0	77597.9	74978.0
2007	270092.3	89210.0	137324.0	93627.1	75321.0
2008	319244.6	114830.1	172828.0	100394.9	75564.0
2009	348517.7	132678.4	224599.0	82029.7	75828.0
2010	412119.3	156998.4	278122.0	107022.8	76105.0
2011	487940.2	193918.6	311485.0	123240.6	76420.0
2012	538580.0	210307.0	374695.0	129359.3	76704.0
2013	592963.2	237809.9	446294.0	137131.4	76977.0
2014	643563.1	271896.1	512021.0	143883.8	77253.0
2015	688858.2	300930.8	562000.0	141166.8	77451.0
2016	746395.1	332316.3	606466.0	138419.3	77603.0
2017	832035.9	366261.6	641238.0	153309.4	77640.0
2018	919281.1	377783.1	645675.0	164127.8	77586.0
2019	990865.1	408017.2	560874.0	172373.6	77471.0

### 2.2 Model setting

According to the scatter diagram of Y and X<sub>1</sub>, X<sub>2</sub>, X<sub>3</sub>, X<sub>4</sub>, y will increase with the growth of X<sub>1</sub>, X<sub>2</sub>, X<sub>3</sub>, X<sub>4</sub>. The OLS model is built based on the data, and the assumption model is as follows:

$$Y = \beta_0 + \beta_1 \cdot X_1 + \beta_2 \cdot X_2 + \beta_3 \cdot X_3 + \beta_4 \cdot X_4 + u_i \quad (1)$$

Where, Y represents GDP, X<sub>1</sub> represents the total retail sales of social consumer goods, X<sub>2</sub> represents the total investment in fixed assets, X<sub>3</sub> represents the total export and X<sub>4</sub> represents the number of employment, and u<sub>i</sub> is the random error term.

### 2.3 Parameter estimation

The results of Eviews analysis of China's economic indicators from 1997 to 2019 are shown in Table 2.

**Table 2.** OLS regression results

Variable	Coefficient	Std. Error	t-statistic	Prob.
C	263680.1	260233.2	1.0132	0.3244
X <sub>1</sub>	2.353382	0.132399	17.7749	0.0000
X <sub>2</sub>	-0.280931	0.072195	-3.8913	0.0011
X <sub>3</sub>	1.288731	0.237149	5.4343	0.0000
X <sub>4</sub>	-3.806073	3.648793	-1.0431	0.3107
R-squared	0.998615	Meandependent var		394991.8
Adjusted R-squared	0.998308	S.D. dependent var		294632.5
S.E.of regression	12121.11	Akaike info criterion		21.83295
Sum squared resid	2.64E+09	Schwarz criterion		22.07979
Log likelihood	-246.0789	Hannan-Quinn criter.		21.89503
F-statistic	3245.168	Durbin-Watson stat		2.202738
Prob(F-statistic)	0.000000			

Here are the results of regression analysis:

$$\begin{aligned}
 Y &= 263680.1 + 2.353382X_1 - 0.280931X_2 + 1.288731X_3 - 3.806073X_4 \\
 t &= (1.0132)(17.7749)(-3.8913)(5.4343)(-1.0431) \\
 R^2 &= 0.998615, \bar{R}^2 = 0.998308, F = 3245.168
 \end{aligned}
 \tag{2}$$

### 3. Model testing

From the above analysis, it can be seen that the 2 of the model is greater than 0, which means that the model fits the sample data better, but the significance p value at that time is 0.3107 > 0.05, so only X<sub>1</sub>, X<sub>2</sub>, X<sub>3</sub> are significant for Y, X<sub>4</sub> is not significant, and X<sub>2</sub> and X<sub>4</sub> are negative numbers, which is inconsistent with the actual situation, so the model may have multicollinearity.

#### 3.1 Multicollinearity

To verify the multicollinearity of the model, Eviews software can be used to build a correlation coefficient matrix for judgment. See Table 3 for the correlation coefficient matrix.

**Table 3.** Correlation matrix

Variable	Y	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>
Y	1	0.996781	0.980113	0.954127	0.866631
X <sub>1</sub>	0.996781	1	0.986342	0.935985	0.848127
X <sub>2</sub>	0.980113	0.986342	1	0.939339	0.86609
X <sub>3</sub>	0.954127	0.935985	0.939339	1	0.947111
X <sub>4</sub>	0.866631	0.848127	0.86609	0.947111	1

From the obtained coefficient matrix, it can be seen that the correlation coefficients of their variables are large, which proves that the initially set formula (1) does have multicollinearity, which is likely to have affected the analysis results of the initial model.

Make the following changes to the model according to the knowledge learned, and then continue to make estimates for the following formula according to the above method.

$$\ln(Y) = \beta_0 + \beta_1 \cdot \ln(X_1) + \beta_2 \cdot \ln(X_2) + \beta_3 X_3 + \beta_4 \cdot \ln(X_4) + u_i \quad (3)$$

Re estimate according to the model set in formula (2), and the results are shown in Table 4.

**Table 4.** OLS regression results

Variable	Coefficient	Std.Error	t-statistic	Prob.
C	-24.22527	8.522544	-2.842493	0.0108
ln(X <sub>1</sub> )	0.489833	0.064448	7.600381	0.0000
ln(X <sub>2</sub> )	0.087861	0.056086	1.566561	0.1346
X <sub>3</sub>	4.32E-06	7.32E-07	5.902635	0.0000
ln(X <sub>4</sub> )	2.643167	0.777915	3.39776	0.0032
R-squared	0.999114	Meandependent var		12.57073
Adjusted R-squared	0.998918	S.D. dependent var		0.854421
S.E.of regression	0.02811	Akaike info criterion		-4.115728
Sum squared resid	0.014223	Schwarz criterion		-3.868882
Log likelihood	52.33088	Hannan-Quinn criter.		-4.053647
F-statistic	5076.951	Durbin-Watson stat		0.982848
Prob(F-statistic)	0.000000			

At this time,  $R^2=0.999336$ ,  $\bar{R}^2=0.998918$ , and the decision coefficient meets the expected value, and the F value is 5076.951. Relatively significant. In  $\alpha=0.05$ , all coefficient estimates are highly significant. The symbols of explanatory variables are also consistent with the actual situation, that is, the total retail sales of social consumer goods, total investment in fixed assets, total exports and employment are all positively related to GDP.

### 3.2 Heteroscedasticity

As for whether there is Heteroscedasticity in this model, this paper adopts white method to verify formula (2). The results of white test are shown in Fig.1.

F-statistic	2.914620	Prob. F(10,12)	0.0415
Obs*R-squared	16.29221	Prob. Chi-Square(10)	0.0916
Scaled explained SS	10.22722	Prob. Chi-Square(10)	0.4208

**Fig.1** White test results

It can be seen from the data in the figure that  $R^2 = 16.29221$ . According to the white test, in  $\alpha=0.05$ , it can be seen from the table that because  $R^2 = 16.29221 < \chi_{0.05}^2(12) = 21.062$ , there is no Heteroscedasticity in the model, so there is no need to eliminate heteroscedasticity.

### 3.3 Autocorrelation

Because the existence of autocorrelation may cause the accuracy of model prediction to decrease, it is very necessary to conduct autocorrelation test on the model. From the data in Table 4, we can see that  $DW = 0.708005$ . By looking up the table, we know that at this time  $D_L = 0.982848$ ,  $D_U = 1.828$ , so  $0 < DW < D_L$ , indicating that there is a positive autocorrelation in the model. DW test can only be used to test first-order autocorrelation, but the model may have high-order autocorrelation. Next, the partial correlation coefficient test is needed to judge whether the model has high-order autocorrelation. The test results are shown in Fig.2.

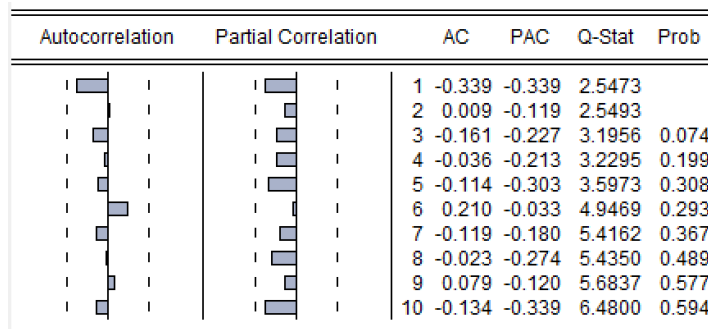


Fig.2 Partial correlation coefficient test

The autocorrelation is judged according to whether the value of  $|PAC|$  is greater than 0.5. It can be seen from Figure. 2 that the model not only has first-order autocorrelation, There is also fourth-order autocorrelation.

In this paper, the generalized difference method is used to eliminate the autocorrelation in the model. The autocorrelation in the model is corrected by using the Cochrane Orcutt iterative method. The results are shown in Table 5.

Table 5. Cochrane Orcutt estimation results

Variable	Coefficient	Std.Error	t-statistic	Prob.
C	-32.69389	14.96994	2.18397	0.0495
ln(X <sub>1</sub> )	0.543424	0.08134	6.680928	0.0000
ln(X <sub>2</sub> )	0.105418	0.076276	1.382064	0.1921
X <sub>3</sub>	2.68E-06	5.17E-07	5.1921	0.0002
ln(X <sub>4</sub> )	3.336377	1.357466	2.457798	0.0302
AR(1)	0.77471	0.186204	4.160533	0.0013
AR(4)	-0.626336	0.210699	-2.972661	0.0116
R-squared	0.999505	Meandependent var		12.81885
Adjusted R-squared	0.999257	S.D. dependent var		0.719026
S.E.of regression	0.019595	Akaike info criterion		-4.749771
Sum squared resid	0.004608	Schwarz criterion		-4.40182
Log likelihood	52.12283	Durbin-Watson stat		2.595465
F-statistic	4037.417	Prob(F-statistic)		0.000000
Inverted AR Roots		0.87+.56i	0.87-.56i	

From Table 5, we can know that  $DW = 2.59595465$ , and it can be judged that  $DU < DW < 4 - DU$ , which indicates that in  $\alpha = 0.05$ . The generalized difference model has no first-order autocorrelation at 0.05, and the partial correlation coefficient is used again to test whether the model has high-order autocorrelation (as shown in Fig.3).

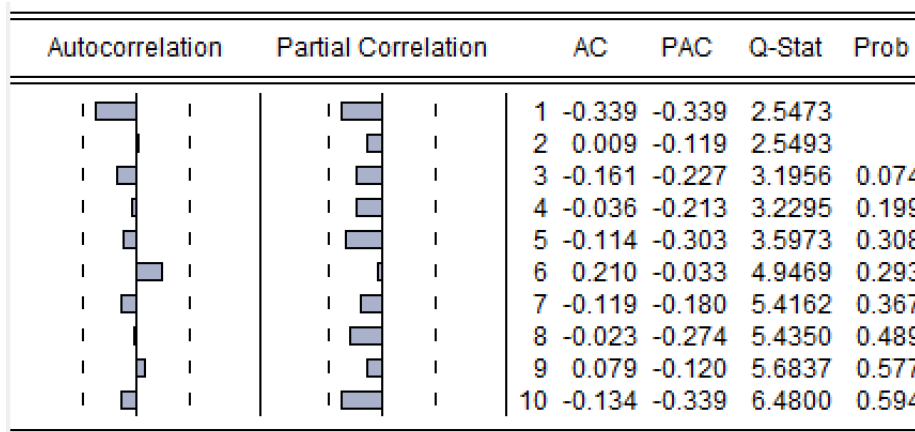


Fig.3 Partial correlation coefficient test of modified model

It can be seen from the results in Figure. 3 that the model has eliminated the autocorrelation after the generalized difference.

### 3.4 Model prediction

Combined with the above discussion, the final equation can be obtained through Eviews software regression:

$$\ln(Y) = -32.69389 + 0.543424\ln(X_1) + 0.105418\ln(X_2) + 2.68E - 06X_3 + 3.336377\ln(X_4) \quad (4)$$

This model is consistent with the actual results of economic operation and can be used to analyze real problems. Since the regression results pass the F test and DW test, the possibility of pseudo regression is basically excluded.

## 4. Conclusions and policy recommendations

### 4.1 Conclusions

Based on the empirical analysis of China's GDP, consumption, fixed asset investment, export and employment from 1997 to 2019, this paper draws the following conclusions: consumption, fixed asset investment and export will still promote China's economic development, and the number of employment will also promote economic growth to a certain extent.

### 4.2 Policy recommendations

#### 4.2.1 Increase residents' consumption expenditure

The following measures can be taken to increase the consumption expenditure of residents: first, promote the construction of the social security system. After the social security system is improved, residents will not blindly save, but will transform part of their savings into material and spiritual needs, thereby increasing consumption expenditure. Second, encourage credit consumption. There is still a big gap between China's consumption credit scale and that of European and American countries. Many regions in the world have regarded this way as an effective means to promote consumption. To this end, banks should promote some consumer credit varieties and encourage residents to actively consume, so as to improve the intensity of residents' consumption.

#### 4.2.2 Further improve the investment layout

With the advancement of industrialization and urbanization, China's investment layout needs to be further improved to further improve investment efficiency. The government should pay attention to the investment in rural areas and make full use of the idle resources in rural areas, which is not only conducive to economic growth, but also drive the development of rural economy; Secondly, the government should encourage investment in some infant industries with good prospects and increase support for innovative enterprises. A country needs to constantly inject new energy, and relying on a single investment to promote economic growth is not a perfect solution. We should increase investment in emerging and innovative industries to enrich and diversify investment in order to maintain steady economic growth.

#### 4.2.3 Optimize the structure of export products

At present, the world has a strong demand for high-tech products, weakening the demand for labor-intensive products. For China, a country that mainly exports manufactured products, it undoubtedly weakens China's exports. China should adjust the structure of export products, increase technological investment, and improve the competitiveness of products in high-end technology.

#### 4.2.4 Improve the comprehensive quality of employees

In recent years, the increasing enrollment of Chinese universities has further expanded the number of high-quality talents in China. However, the skills of college students are out of line with the needs of enterprises. Therefore, the skills training of schools should be closely combined with social needs to improve the employment rate of college students. For those who are unemployed, it is necessary to let them learn professionally and further improve their comprehensive quality.

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