# Study on the Relationship among Investment, Household Consumption and Economic Growth

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## Abstract

**VAR model is used in this paper to discuss the relationship among gross investment 、gross household consumption and economic growth in China from 2002 to 2019. The results of empirical research show that: (1) economic growth is mainly dependent on its own factors, the impact of gross household consumption on economic growth is relatively weak, while the impact of gorss investment on economic growth is relately strong ; (2) improving wage income should not only increase standard of living of the household, but also increase effective demand and stimulate economic growth; (3)to control investment size and optimize investment structure, can improve investment efficiency and promote economic growth.**

## Keywords

**Gross consumption; Gross investment; Economic growth; Impulse response.**

## 1. Introduction

Eonomic growth is one of the important objectives of fiscal policy. Higher economic growth means a higher employment rate, which is the basis of stable development of economy and society. According to fiscal theory, the important factor of economic growth is aggregate demand, which includes investment demand, household consumption demand and export demand. Investment demand and household consumption demand are internal demand, export demand is external demand. External demand is uncontrollable to some extent. Therefore, this paper mainly research the domestic demand, namely investment demand and consumption demand.

Generally speaking, increasing aggregate demand will stimulate aggregate supply, which will expand production and increase employment; higher employment level will lead to a higher income, which will leads to a higher level of demand and a higher level of gross supply. However, the total resources of a society are limited. Increase of investment will inevitably leads to the decrease of household consumption. The decrease of household consumption will lead to the decrease of demand, which in turn will lead to the decrease of income and employment. Also investment demand and household consumption demand have different influence on economic growth. Consumption is final demand and investment is shadow demand. In addition, they have different size, investment demand has much larger size than consumption size. furthermore, gross investment and gorss household consumption have different investment structure and consumption structure.

Domestic researchs on relationship among consumption demand, investment demand and economic growth show that there are mainly three kinds of views: (1) Xu Tingting[1] research shows: there is a two-way causal relationship between fixed asset investment and economic growth, which indicates that investment and economic growth have mutual promotion effect. However, with the increasing of fixed asset investment, the pulling effect on economic growth does not increase in a positive proportion. That is to say, the promotion effect of fixed assets investment on economy is declining. Li Qingfeng[2] research shows: there is a long-term and short-term equilibrium relationship between fixed asset investment and economic growth. When the fixed asset investment increases by 1%, the GDP will increase by 0.620711%. Sun Haitao[3] research shows: the increase of consumption demand is the main factor affecting economic growth, and the increase of GDP is also the main factor

affecting the increase of consumption demand; the increase of investment demand is the main factor affecting economic growth, and the increase of GDP is also the factor affecting the increase of investment demand

(2) Ji Ming[4] research shows that consumption demand is the initial demand driving force of economic growth, and its driving effect on economic growth changes from strong to weak and then strong, and the driving effect of investment demand oriented by consumption demand on economic growth changes from weak to strong and then weak again; (2) compared with consumption demand, the existence of "investment lag" and "investment inertia" of investment demand makes investment and consumption often grow asynchronously, It leads to economic imbalance and regular fluctuation of price level.

(3)Economic growth needs to be driven by the coordination of consumption, investment and export. Han Yongwen[5] estimated that China's consumption rate is significantly lower than the world level, while the investment rate is higher than that of other Asian countries at the same stage of development, and the net export rate is higher than the international level. Over-high investment rate will bring about imbalances in economic structure, especially in industrial structure, which will bring about long-term economic no-coordination. Therefore, China should reduce its investment rate, increase its consumption rate and promote the coordinated promotion of consumption, investment and export.

## 2. Empirical Research

In this paper gdp represents gross demestic product, tz represents gross investment, xf represents gross comsumption, and rgdp represents the growth rate of gdp, rtz and rxf represents the growth rate of investment and consumption respectively. The data of GDP and gross investment and gross consumption from 2002 to 2019 are derived from the websites of Zhonghong. Data of rgdp and rtz and rxf are caculated.

Table 1. Dataset of 2002-2019.

| year | gdp | tz | xf |
|---|---|---|---|
| 2002年 | 121717.4 | 43499.9 | 4301 |
| 2003年 | 137422 | 55566.6 | 4606 |
| 2004年 | 161840.2 | 70477.43 | 5138 |
| 2005年 | 187318.9 | 88773.61 | 5771 |
| 2006年 | 219438.5 | 109998.16 | 6416 |
| 2007年 | 270232.3 | 137323.94 | 7572 |
| 2008年 | 319515.5 | 172828.4 | 8707 |
| 2009年 | 349081.4 | 224598.77 | 9514 |
| 2010年 | 412119.3 | 278121.9 | 10919 |
| 2011年 | 487940.2 | 311485.1 | 13134 |
| 2012年 | 538580 | 374694.7 | 14699 |
| 2013年 | 592963.2 | 446294.1 | 16190 |
| 2014年 | 643563.1 | 512020.7 | 17778 |
| 2015年 | 688858.2 | 561999.8 | 19397 |
| 2016年 | 746395.1 | 606465.7 | 21285 |
| 2017年 | 832035.9 | 641238.4 | 22935 |
| 2018年 | 919281.1 | 645675 | 25378 |
| 2019年 | 990865 | 560874 | 27563 |

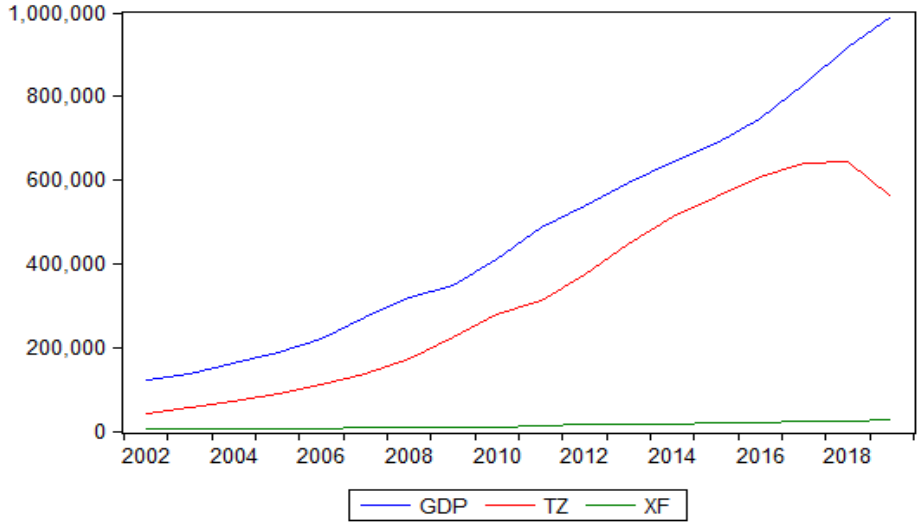


Fig.1 GDP gross investment and gross consumption

From the trend chart of Figure 1, it can be seen that the GDP, the gross investment and the gross consumption show an obvious upward trend with the change of time, with trend and intercept. it can be judged basically that the time series of GDP and gross investment and gross consumption have non-stationary characteristics. in order to examine the relationship between GDP and gorss inventment and gross consumption, this paper uses VAR model to analyze the relationship. Therefore, taking the growth rate GDP, growth rate of gross investment and gross consumption as the original sequence, this paper makes an empirical analysis of the relationship amomg them.

The basic assumption of Var model is the stability of time series. In order to ensure the validity of regression and avoid the occurrence of pseudo-regression, time series data first need to pass the stationarity test. In this paper, the ADF method is used to test the stability of the sequence.

Table 2. Results of Stationarity Test

| | rgdp | rtz | rxf | drgdp | drtz | drxf |
|---|---|---|---|---|---|---|
| adf | -3.430811 | -0.975170 | -3.057712 | -5.417785 | -4.008828 | -5.597851 |
| 1% | -4.728363 | -4.728363 | -4.728363 | -4.800080 | -4.800080 | -4.800080 |
| 5% | -3.759743 | -3.759743 | -3.759743 | -3.791172 | -3.791172 | -3.791172 |
| 10% | -3.324976 | -3.324976 | -3.324976 | -3.342253 | -3.342253 | -3.342253 |
| p | 0.0848 | 0.9169 | 0.1505 | 0.0039 | 0.0355 | 0.0029 |
| Check Type | c,t,1 | c,t,1 | c,t,1 | c,t,1 | c,t,1 | c,t,1 |
| | Non-stationary | Non-stationary | Non-stationary | stationary | stationary | stationary |

As can be seen from Table 2, the ADF test values of the growth rate of GDP、growth rate of gross investment and gross consumption, are all greater than the critical values at the significant levels of 1%, 5% and 10%, and there are unit roots, all the time series of rgdp, rtz and rxf are unstable. However, the first-order difference is stable at the significant level of 5%, and all the time series of growth rate of GDP, growth rate of investment and growth rate of consumption are one-order single integral at the significant level of 1%. So, there may be a long-term equilibrium relationship among them, that is, cointegration relationship.

Table 3. Results of Cointegration Test.

| | | | | | |
|---|---|---|---|---|---|
| Trace Test | Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob.** |
| | None * | 0.956291 | 62.75193 | 29.79707 | 0.0000 |
| | At most 1 | 0.679112 | 18.92901 | 15.49471 | 0.0146 |
| | At most 2 | 0.193789 | 3.015729 | 3.841466 | 0.0825 |
| Maximum Eigenvalue | Hypothesized No. of CE(s) | Eigenvalue | Max-Eigen Statistic | 0.05 Critical Value | Prob.** |
| | None * | 0.956291 | 43.82293 | 21.13162 | 0.0000 |
| | At most 1 | 0.679112 | 15.91328 | 14.26460 | 0.0272 |
| | At most 2 | 0.193789 | 3.015729 | 3.841466 | 0.0825 |

Table 3 shows that the trajectory test results reject the original hypothesis that there is no co-integration relationship, which indicates that there is one co-integration relationship among economic growth rate, growth rate of gross investment and gross consumption at the 5% significant level. At the same time, the maximum eigenvalue test supports the result of trajectory test.

Lag period must be designed to set VAR model . If the lag period K is too small, it will lead to inconsistent of parameters estimation. In VAR model, increasing lag variables properly can eliminate the existence of autocorrelation, but the larger lag period K will lead to reduced degrees of freedom, which affect the effectiveness of parameter estimation. In this paper, the AKaike information criterion AIC is used to select the lag period. The lag period k is designed to be 2 by testing, and the model is set to VAR (2). The result of parameter estimation is expressed in matrix form as follows:

$$\begin{pmatrix} drGDP \\ drtz \\ \text{drxf} \end{pmatrix} = \begin{pmatrix} -1.306799 \\ -2.731158 \\ -0.2644643 \end{pmatrix} + \begin{pmatrix} -0.272506 & -0.053558 & -0.015868 \\ -0.094006 & -0.077582 & 0.270359 \\ 0.325959 & -0.080701 & -0.454694 \end{pmatrix} \begin{pmatrix} drGDP(-1) \\ drtz(-1) \\ \text{drxf}(-1) \end{pmatrix} + \begin{pmatrix} -0.834034 & -0.258180 & 0.101368 \\ -0.278909 & 0.208786 & 1.314492 \\ -0.644643 & 0.055109 & 0.207312 \end{pmatrix} \begin{pmatrix} drGDP(-2) \\ drtz(-2) \\ \text{drxf}(-2) \end{pmatrix}$$

The test results of the VAR model show that the eigenvalues are all in the unit circle (see Fig. 1), and the residual sequence obeys normal distribution, and there is no hetero-scedasticity and autocorrelation, that is, there is no deviation in Var model.

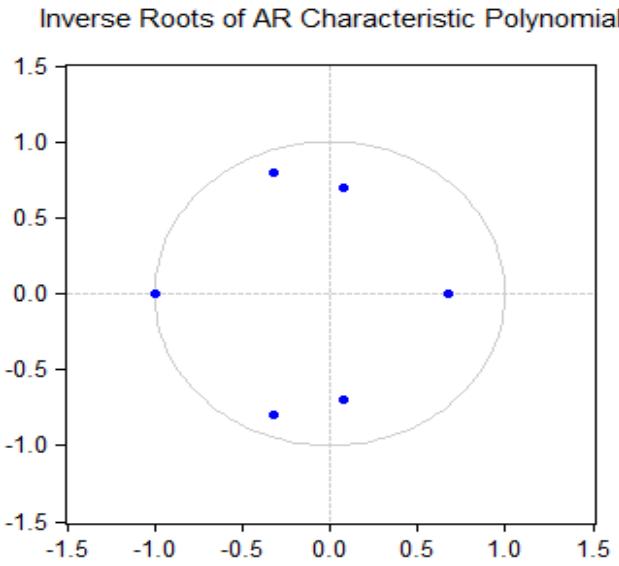


Fig. 2 Inverse Roots of AR Characteristic Polynomial

## 3. Impulse Response Analysis

Since the OLS parameters estimators of VAR model has only consistency, it is difficult to interpret the single parameter estimators economically, so it is necessary to analysis the impulse response of the system. Impulse response function (PRF) is the response of an endogenous variable to an random error shock. It describes the impact of a standard deviation shock on the current and future values of the endogenous variable, Figure 2 shows the results of inpluse response:

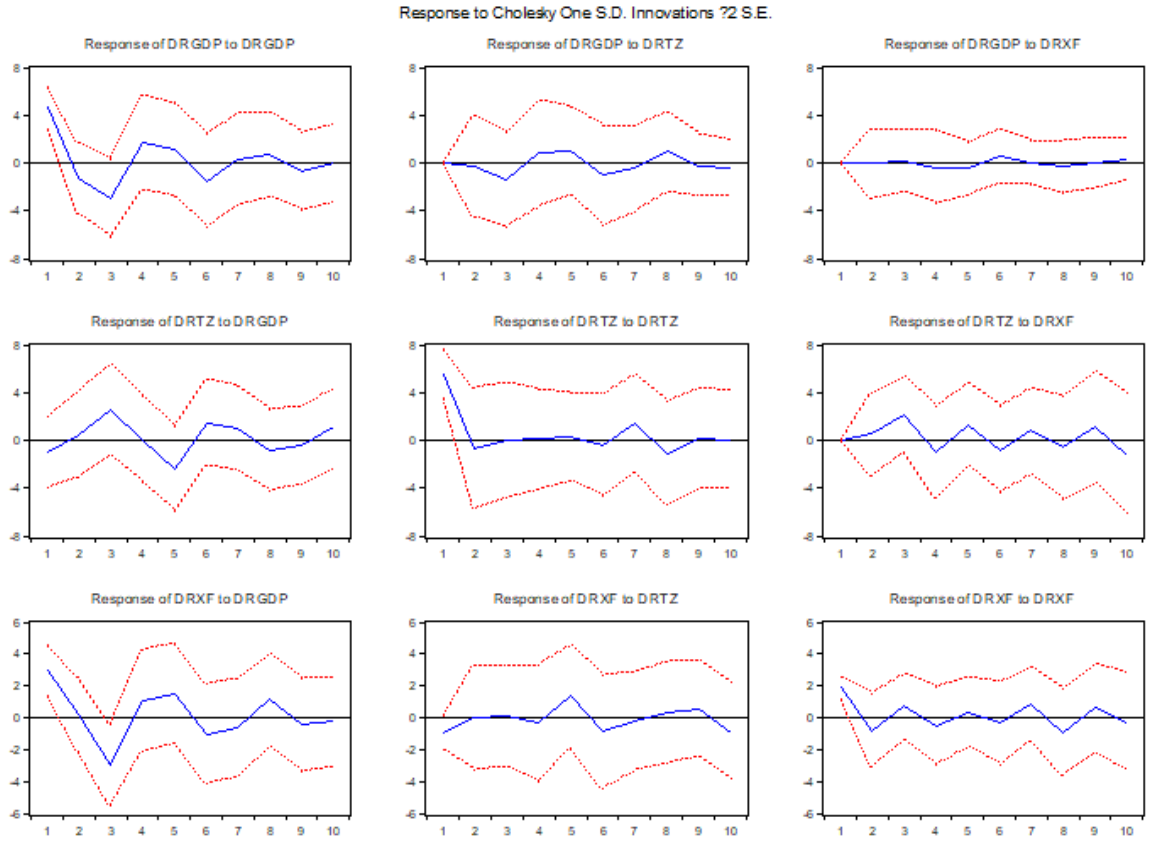


Fig. 3 Inpluse Response

Given a standard deviation shock to per capita consumption expenditure of urban resident, there is a negative impact on GDP in the 1-2 period, a positive impact in the 2-4 period, and again a negative impact in the 4-6 period, and a gradual weakening of the impact after the 7 periods. This means that the increase of consumption demand of urban residents may lead to insufficient supply and inflation, and then have a negative impact on GDP. With the gradual adjustment of production and the increase of supply, consumption demand of urban residents promote economic growth, the impact of rural residents' consumption on GDP is weak, probably due to the smaller consumption expenditure of rural residents.

given a standard deviation shock on GDP, there is a positive impact on the per capita consumption expenditure of urban residents in the period 1-2, a negative impact in the period 2-4, and again a positive impact in the period 4-6, and a gradual weakening of the impact after the period 7. This means that economic growth will promote the consumption expenditure of urban residents, but the growth of consumption expenditure of urban residents may lead to an increasing in investment demand, which in turn will have a crowding-out effect on consumption expenditure and lead to a decreasing in consumer demand. However, with the adjustment of production and the increase of supply, it will also promote the increase of consumer demand. The influence of the consumption expenditure of rural residents on consumption expenditure of urban residents is weak, and consumption expenditure of rural residents has no effect on urban residents' consumption expenditure.

given a standard deviation shock on GDP, there is a positive impact on the consumption expenditure of rural residents in the period 1-2, a negative impact in the period 2-4, and again a positive impact in the period 4-6, and a gradual weakening of the impact after the period 7. This means that economic growth will boost the consumption expenditure of rural residents, but consumption expenditure may increase the demand for investment, which will have a crowding-out effect on consumption expenditure, resulting in less consumption expenditure of rural residents. But with the adjustment of production and the increase of supply, it will promote the increase the consumption expenditure of rural residents. The expenditure of Urban residents has a weak impact on rural residents, which indicates that the consumption expenditure of urban residents has a certain demonstration effect on rural residents.

## 4. Conclusion and Suggestion

Gross household consumption in China is relatively small, which has become an important factor in restraining economic growth. The basic data shows that the gross household consumption only accounts for about 3% of GDP in the past two decades. Household consumption expenditure is direct demand, and the increase of direct demand can lead to the increase of private investment demand. Therefore, improving salary income can increase effective demand, which is the most fundamental way to stimulate economic development. It is suggested that government should further improve the social security system, which can solve the worries of residents' consumption, and further release the consumption potential. Second, government should further increase the wage income. The proportion of wage income of employees to GDP is relatively low, which has not exceeded 20%. Wage income is the most important part of the disposable income of most household. Therefore, improving wage income should not only increase standard of living of the household, but also increase effective demand and stimulate economic growth.

Gross investment in china is relatively large, which has become the most important factor of economic growth. The basic data shows that the proportion of investment to GDP has been more than 50% in recent ten years. Large scale investment will produce crowding out effect on consumption to a certain extent. Therefore, it is a correct to properly control investment demand. Secondly, from the perspective of investors, private investment is smaller and government investment is much large. From the perspective of investment direction, the most investment is public infrastructure investment, with less productive investment. Therefore, to optimize the investment structure, which is to encourage private investment and productive investment, can improve investment efficiency and promote economic growth.

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