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Relationship between Fixed Assets Investment and GDP in Shenzhen

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Abstract

Fixed assets investment behavior and macro-economic operation have an important relationship. Based on the statistical data of Shenzhen from 1992 to 2016, the econometric model of GDP and fixed assets investment is established by using the unit root test method, cointegration theory and Granger causality test. It is concluded that there is a long-term stable equilibrium relationship between Shenzhen GDP and fixed asset investment, and there is bidirectional Granger causality. Therefore, it is concluded that the fixed assets investment has promoted the economic development of Shenzhen, but only by innovating the financing channels, optimizing the investment environment and improving the investment quality can the Shenzhen economy develop more qualitatively.

Keywords

Fixed asset investment; GDP; Granger causality.

1. Introduction

In 1979, it was a spring, and an old man drew a circle near the South China Sea. The Shenzhen Special Economic Zone is the first special economic zone initiated and promoted by the chief designer of Chinaundefineds reform and opening up. As a laboratory and window for promoting Chinese economic and social development, the Shenzhen Special Economic Zone has been formally established since its establishment in August 1980, and has only taken more than 30 years. From a rural area to Chinese four major cities, has achieved great success. In 2017, Shenzhen held high the great banner of socialism with Chinese characteristics in the new era of Xi Jinping, fully implemented the policy plans of the party Central Committee, the State Council, the provincial party committee, and the provincial government, and adhered to the general tone of pursuing progress in a steady and steady manner. Speed up the construction of socialist modernization areas, the city's economy has achieved quality and stable development. After preliminary accounting and approval by Guangdong Statistical Bureau, the gross domestic product of the whole city in 2017 was 2.243839 trillion yuan (including R &D expenditures).

Investment in fixed assets is an activity in which economic entities (such as enterprises, individuals or government agencies) use funds for certain purposes in the acquisition and construction of fixed assets. In the statistical sense, investment in fixed assets is the activity of construction and acquisition of fixed assets. Namely fixed assets reproduction activity. Investment in fixed assets is an important part of national economic reproduction and the most important way of investment. It has the greatest influence on economic fluctuation. Shenzhen's fixed asset investment rose at a high level in 2017, with total investment exceeding 500 billion yuan, according to Shenzhen statistics. Investment in fixed assets totaled 514.732 billion yuan, an increase of 23.8 percent, an increase of 0.2 percentage points over the previous year, a new high since 1994.

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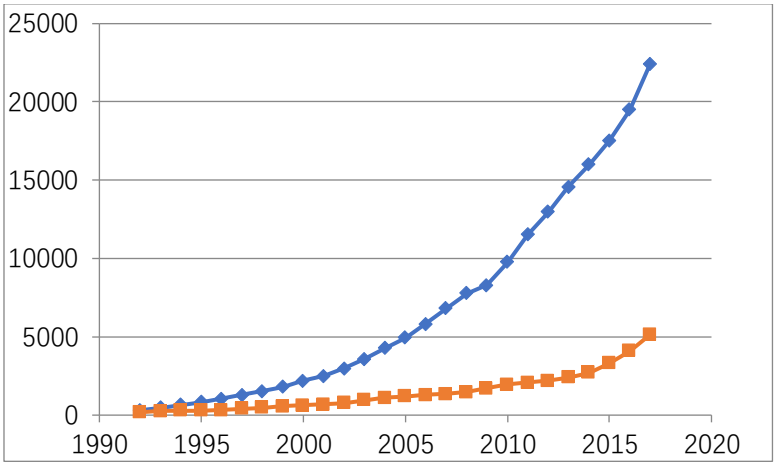

Figure 1 fixed asset investment and GDP breakout line in Shenzhen 1992-2017

It can be seen from figure 1 that the growth trend of GDP and fixed asset investment in Shenzhen shows the same trend in time. The growth of fixed asset investment lags behind the growth of GDP, showing a typical type of investment pull. The fluctuation of growth rate of fixed assets investment in Shenzhen is a direct and material factor that influences the fluctuation of macroeconomic cycle. Fixed assets investment is also the material basis of economic cycle fluctuation and the main factor that induces economic fluctuation. According to the theory of economics, the role of fixed asset investment in economic development is mainly reflected in two aspects: (1) direct promotion; (2) Investment has increased the demand for raw materials and production equipment, and at the same time has led to related domestic demand. This in turn leads to an increase in gross domestic product (GDP). Therefore, we can think that there is a certain relationship between fixed asset investment and economic development.

2. Data selection

This paper selects 1992-2016 as the sample period, the data come from the relevant year of Shenzhen Statistical Yearbook. Taking GDP as the indicator to reflect the economic growth of Shenzhen, generally speaking, as the output volume index of the whole society, we should choose the regional GDP, which is because GDP is the core index of the new national economic accounting system of our country. It reflects the overall level of national economic development in a certain period of time and has relatively complete and standardized historical statistics. The fixed assets investment index reflects the investment demand, which is the capital occupied by the materialized infrastructure and technical equipment, is the basis of all investment activities, and has the greatest influence on the economic fluctuation. Therefore, this paper chooses this as the main research object. It is represented by GDP and INV, respectively. Because the change of these two kinds of data is exponential, the possible heteroscedasticity can be overcome in advance by taking the natural logarithmic transformation of the data and the logarithm of the data sequence respectively.

Table 1 Annual GDP and fixed assets investment in Shenzhen

Year	GDP (billion yuan)	fixed asset investment (billions of yuan)
1992	317.3194	178.2322
1993	453.1445	247.7875
1994	634.6711	281.9413
1995	842.4833	275.8243
1996	1048.4421	327.527
1997	1297.4208	393.0657

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1998	1534.7272	480.3901
1999	1804.0176	569.5878
2000	2187.4515	619.6993
2001	2482.4874	686.3749
2002	2969.5184	788.1459
2003	3585.7235	949.1016
2004	4282.1428	1092.5571
2005	4950.9078	1181.0542
2006	5813.5624	1273.6693
2007	6801.5706	1345.0037
2008	7786.792	1467.6043
2009	8290.2842	1709.1514
2010	9773.3062	1944.7008
2011	11515.8598	2060.918
2012	12971.4672	2199.4319
2013	14572.6689	2391.4648
2014	16001.8207	2717.4226
2015	17502.8634	3298.3076
2016	19492.6012	4078.1638

3. Empirical analysis

3.1 Unit root test

In the field of economy, most macroeconomic time series are non-stationary, also called monolithic, which means that if a non-stationary time series XT must pass through d difference to transform into a stable, reversible ARMA time series, Then XT has order d uniteness. Therefore, it is necessary to test the stability of time series before model analysis to avoid false regression. False regression-if there are two series of data showing a consistent non-stationary trend, even if they do not have any meaningful relationship, but the regression can also show a higher determinable coefficient. Therefore, a strict statistical test method should be used to test the nonstationarity of variables. One of the widely used stationary test methods is the unit root test. In this paper, the ADF test method is used. The test order is to select whether the formula contains the trend term and the constant term, and then to select whether the test formula contains the constant term or not. If there are any additional items in the final test, if the test result is sequence without unit root, then the test ends. The Eviews8.0 software is used to test the stability of the variables, and the results are shown in the table.

Table 2 results of unit root test

Sequence name	Inspection form （C, T, P）	ADF test	Threshold		Stationary
InGDP	(C,T,5)	-5.17	（5%）	-3.61	Stationary
InINV	(C,T,5)	-1.80	（5%）	-3.63	Non-stationary

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D(InGDP)	(C,0,5)	-2.84	（10%） -2.64	Stationary
D(InINV)	(C,0,5)	-4.53	（10%） -2.64	Stationary

Note: (1) the test includes constant terms, and the trend term (P) does not include the trend term (P) to indicate the number of lag terms determined according to the Schwarz information criterion.

The unit root test results show that the first order difference of InGDP, InINV, D (InGDP), D (InINV) ADF statistics are less than 10% significant levels, and refuses the nonstationary original hypothesis, that is, the D (InGDP), D (InINV) sequence is stationary and the original sequence is a first order integer sequence. If there is a long-term stable equilibrium relationship between variables, it can not be analyzed by traditional regression method. It is necessary to further test the cointegration relationship among variables.

3.2 Cointegration test

The cointegration relationship between variable sequences means that although the sequence of variables is a non-stationary sequence, some linear combination of variables may have some stability. The long-term equilibrium relationship among these variables is cointegration. In this paper, the first order difference sequence of the primary sequence is stationary, and the cointegration relation can be tested.

Firstly, cointegration regression of InGDP InInv is carried out.

$$InGDP_t=1.202InINV_t+e_t$$

(215.4)

R2=0.97 DW=0.27 T=25

The cointegration relationship between InGDP and InINV. AEG regression formula is as follows:

$$D\ e_t =-0.3664e_{t-1}+0.4369D\ e_{t-1}$$

(-4.19) (2.86)

R2=0.54 DW=1.62 T=23

Residual ADF test results:

			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.192174	0.0002
Test critical values:	1% level		-2.669359	
	5% level		-1.956406	
	10% level		-1.608495	

According to the formula of critical value C（P）of McKinnonundefineds cointegration test, the formula is as follows:

$$C_{0.05}=-3.3377-5.967/25-8.98/252=-3.590748$$

The ADF test for residuals is carried out in the form of (0,0,5). There is neither a constant term nor a trend item and 5 indicates the number of lag terms determined according to the Schwarz information criterion. From the test results, the ADF test statistical value of residuals -4.1921 is smaller than the critical value -3.590748, so the original hypothesis of unit root is rejected, and the residual sequence is considered to be a stationary sequence. Therefore, the cointegration relationship between InGDP

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and InINV can be determined, and there is a long-term stable relationship between them. So in the long run, there is a stable equilibrium relationship between Ningb's GDP and Shenzhen's fixed asset investment.

3.3 Error correction model

Error correction model (ECM) can not only reflect the long-term equilibrium relationship between time series, but also reflect the correction mechanism of short-term deviation from long-term equilibrium. According to Granger theorem, if some nonstationary variables have cointegration relations, then there must be an error correction model expression for these variables. The error correction model can only be applied to the sequence of variables with cointegration relationship. The variables in this model have been tested by cointegration relationship. Therefore, the error correction model can be established by using Engle-Granger two-step method.

Table 3 regression results of error correction model

Variable	coefficient estimate	T test value	R2	AIC	DW
D(lnINV(-1))	0.1407	1.0808	0.7751	-3.9402	2.4998
D(InGDP(-1))	0.6278	6.4713			
ECM	-0.0966	-1.1524			

This paper mainly uses the error correction model of a single equation, which consists of disequilibrium error, difference variable of original variable and random error term. The error correction model is as follows:

$$D(InGDP)=0.0384+0.1407D(lnINV(-1))+0.6278D(InGDP(-1))-0.0966ECM_{t-1}$$

From the result of error correction model, it can be seen that fixed asset investment has a significant positive effect on the growth of GDP, and the coefficient of error correction is -0.0966, which conforms to the reverse correction mechanism. It shows that the difference between the real value of GDP and the long term equilibrium is about 9.66% in the short term. Specifically, the increase of fixed asset investment by one unit will increase the GDP of Shenzhen by 0.1407 percentage points in the first year, which is consistent with the theoretical analysis and empirical judgment. It also shows that the fixed assets investment in Shenzhen has a great pulling effect on the growth of GDP.

3.4 Granger causality test

The Granger causality test can be used to determine whether there is a causal relationship between economic variables and the direction of influence. In Granger causality, the sequence is always assumed to be stationary, so, The variable data used in the analysis are the variables after the first order difference. In this paper, AIC information criterion and SC information criterion are adopted to determine the order. The results of Ganger causality test on GDP and fixed asset investment in Shenzhen are as follows:

Table 4 Granger causality test results

Null Hypothesis	F-Statistic	Prob.	Conclusion
GDP does not Granger Cause fixed asset investment	5.69870	0.0121	Reject the null hypothesis
fixed asset investment does not Granger Cause GDP	5.52122	0.0135	Reject the null hypothesis

Note: when $P < 0.1$, the original hypothesis was rejected.

The results show that at the 10% confidence level, the GDP in the sample interval is the Granger cause of the change of fixed asset investment, and the fixed asset investment is also the Granger cause

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of the change of GDP. It shows that the fixed assets investment drives the growth of the total economic quantity, and the economic aggregate growth drives the growth of the fixed assets investment.

Based on the analysis of the effect of fixed asset investment on total economic growth in Shenzhen, it can be concluded that the co-integration relationship test shows that there is a long-term equilibrium relationship between fixed asset investment and GDP in Shenzhen, and the error correction model shows that the relationship between them is significant in the short term. Granger causality test shows that there is a two-way causal relationship between the two.

4. Analysis and suggestion of empirical results

4.1 Empirical analysis

Demand effect of GDP growth on fixed assets investment. Generally, total demand consists of four parts: consumer demand, investment demand, government expenditure and export demand. Consumer demand is relatively stable in the short term, government spending will be limited by the fiscal situation, and exports will be affected by trade barriers and other factors are uncertain. Therefore, the investment demand becomes the main force which maintains the economic growth. From the fixed asset investment data, we can see that Shenzhen, as the first non-rural city in China, is the economic center of the Pearl River Delta and the southern part of the mainland. The proportion of investment in the tertiary industry rose to the first place. In recent years, Shenzhen has vigorously developed high-tech and financial industries, and has taken a path of gradual and rapid industrial upgrading and transformation. Many of the old industrial zones have been transformed into high-end industrial agglomerations. At the same time, the investment in introducing and building major high-end projects has gathered new momentum for the future of the city. In 2017, Shenzhenundefineds official resident population increased by 620000 people and the growth of gross domestic product attracted a large number of foreign working-age people. Population growth not only brings Shenzhen a demographic dividend, but also drives the fixed assets investment in Shenzhen.

The supply effect of fixed assets investment to GDP. The supply effect of investment means that investment activities can inject new factors of production into the process of social reproduction, form new capital and expand the scale of social reproduction. On the one hand, the capital stock will decrease with time, in order to maintain the social capital stock, we need to make up for it. On the other hand, investment is an important way to realize the increment of social capital. According to Keynes's theory of investment multiplier effect, "when the total investment volume increases, the increase of income will be k times that of investment increment." Under a certain marginal propensity to consume, a certain amount of new investment increases after a certain period of time. This will lead to an increase in income and employment by several times, or a (1 / 1 - β) of fixed asset investment exceeding 500 billion yuan for the first time in a year of GDP.2017, which will add more momentum to economic development.

4.2 The countermeasures to improve the investment effect of fixed assets

4.2.1 Innovative financing channels

Innovation is a driving force for a city. According to Chennari's theory of industrialization stage model, Shenzhen has now entered the post-industrialization stage, that is, the internal structure of manufacturing industry has been transformed from capital-intensive industry to technology-intensive industry, and the modernization of life style. High-grade durable goods are popularized. The rapid development of technology-intensive industries is the main feature of this period. Therefore, we need to find an innovative and competitive industrial upgrading road. In the market economy, is the enterprise independent decision generally carries on the investment. In China, although enterprises have certain autonomy in fixed asset investment, due to the influence of traditional system, a large part of the decision-making is in the hands of administrative organs, so it is necessary to broaden the financing channels. We will actively utilize foreign capital, increase efforts to attract investment, and

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guide foreign investment to agriculture, high-tech industries and urban public utilities. We should support the innovative development of private investment, relax the entry threshold and conditions of the private market, encourage the transregional transfer of private investment, and then change the unbalanced development of the region and activate the economic development of the backward areas.

4.2.2 Optimizing the investment environment

The cyclic cumulative causality theory holds that the process of economic development begins with some better regions, and so does a good investment environment. Once these regions develop ahead of other regions because of the advantages of the initial investment environment, Through the cumulative causality process, these regions continue to accumulate favorable investment factors and develop ahead of time, which leads to the spatial interaction between the growth regions and the lagging regions, and the difference is becoming smaller and smaller. For example, real estate investment has been occupying a large proportion in Shenzhen fixed assets investment. In 2017, the added value of Shenzhen real estate industry was 188.21 billion yuan, an increase of 1.7 yuan, of which real estate development investment was 213.586 billion yuan, an increase of 21.6 yuan. Real estate investment is booming, but on the other hand, high house prices have deterred provincial workers who want to settle in Shenzhen. To optimize the investment environment is to adhere to the principle of systematization, systematically grasp the balance of all elements in the economy, and make a comprehensive combination. The improvement of one factor can not stimulate investment, while the deterioration of the other factor restricts investment in turn. To optimize the investment environment, we should adhere to the principle of marketization and the mutual benefit of the market economy. We should not only consider the needs of investors, but also consider the present situation of the supply side of Shenzhen market to promote long-term development.

4.2.3 Improving the quality of investment

Shenzhen's economy develops steadily and qualitatively, thanks to the rapid development of the real economy represented by industrial production. Should invest energetically with advanced manufacturing industry and high-tech manufacturing industry, to stimulate talent vitality to the maximum extent. Shenzhen is attractive to the population and talent, and sustained population growth will keep the economy dynamic. Therefore, we should enhance the social benefits of investment, people-oriented, and build a resource-saving and environmental-friendly society. It is also necessary to optimize the efficiency of resource allocation. From the point of view of resource utilization, the final analysis is whether or not to achieve high efficiency and high efficiency of production. In the input of investment elements, the government should also give full play to the role of market competition mechanism, encourage enterprises to increase technology research and development, improve the utilization efficiency of land and other resources, reduce operating costs, and improve economic benefits.

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