# Empirical Study on the Relationship between Real Estate Investment and Economic Growth in Hainan Province

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**Abstract.** As an important part of fixed assets investment, real estate investment plays an important role in the process of stimulating economic growth. Taking the time series data of real estate investment and economic growth from 2005 to 2015 in Hainan Province as the sample of statistical analysis, this paper comprehensively applies unit root test and cointegration test. The relationship between real estate investment and economic growth in Hainan Province is discussed by establishing error correction model and Granger relation test. The results show that:(1) The relationship between real estate investment and economic growth in Hainan Province is a long-term dynamic equilibrium. (2) The fluctuation of economic growth in Hainan Province can be divided into two parts: short-term fluctuation and long-term equilibrium. (3) The real estate investment in Hainan Province can be divided into two parts: one is short-term fluctuation and the other is long-term equilibrium. And economic growth between the one-way causality. That is, the growth of real estate investment is the cause of economic growth, economic growth does not necessarily lead to the growth of real estate investment.

**Keywords:** Real estate investment; Economic growth; Hainan; Econometric model.

## 1. Introduction

In recent years, the scale of real estate investment in Hainan Province has increased year by year, and at the same time, it has achieved a more obvious economic growth. The real estate investment has increased from 7.09 billion yuan in 2005 to 170.39 billion yuan in 2015. Investment in real estate development accounted for 7.71% of GDP to 46.02%. Some domestic scholars have also made a theoretical and empirical analysis of the relationship between real estate investment and economic growth. Zhu Qiang (2019) analyzed the influence mechanism of real estate investment on economic growth, held that the process of urbanization construction in China and the structure of real estate investment in our country should be perfected at the same time, on the basis of which the housing price should be adjusted reasonably. We will effectively promote the further development of our social economy.Wang Zhongxiu (2018), based on the data of real estate investment and national economic growth from 2001 to 2016, examines the relationship between real estate investment and inclusive growth of national economy by using scattered plot.Wang Zhen (2018) established a measurement model based on the data of Wuhan City, and proposed that the investment scale of real estate development should be reasonably determined according to the present situation and orientation of urban development, and at the same time, it should create diversified economic development points. Avoid over-reliance on real estate investment.Yang Xiaowei (2018) analyzed the relationship between real estate investment and economic growth based on Guizhou Province data.

According to most previous studies, real estate investment can promote economic growth, but due to regional differences and the limitations of samples. At present, empirical research on the real estate investment situation in Hainan Province is relatively scarce.Based on this, the original assumption is $H_1$:Hainan real estate investment and economic growth has a positive correlation.The main contents are as follows: (1) This paper discusses the relationship between real estate investment and economic growth in Hainan Province through empirical analysis, which has certain reference value for ensuring the stability and orderly development of real estate market and social economy in Hainan Province; (2) In this paper, the unit root test, cointegration test, error correction model and Granger causality test are used to provide a more comprehensive perspective for the study of the range of influence between them.

## 2. Modeling and Data Analysis

This article selects Hainan Province 2005-2015 GDP to reflect the economic growth, the real estate development investment reflects the real estate development investment situation.According to the proportion of real estate investment in fixed assets and real estate investment in GDP reflects the overall development trend, in order to achieve the purpose of the expected research and eliminate the impact of variable heteroscedasticity.Then set up the following econometric model to examine the relationship between real estate investment and economic growth:

$$\ln(Y) = \alpha + \beta \ln(X) + \varepsilon \tag{1}$$

In the form1, $Y$ is the indicator of economic growth, $X$ is the indicator of Real Estate Investment, $i$ is the year, $\varepsilon$ is residuals. The unit root test, cointegration test, error correction model and Granger causality test are used to investigate the relationship between them. The tables in this paper are calculated by Eviews9 software, and the results are as follows.

Table 1. Hainan real estate investment table 2005-2015

| Year | Investment in real estates (X) | GDP(Y) | Gross fixed asset formation | Real estate investment in fixed assets% | Real estate investment as a proportion of GDP % | Ln(X) | Ln(Y) |
|---|---|---|---|---|---|---|---|
| 2005 | 70.9 | 918.75 | 379.4 | 18.68 | 7.71 | 4.261270434 | 6.823014051 |
| 2006 | 98.4 | 1031.85 | 426.0 | 23.09 | 9.53 | 4.589040804 | 6.939108587 |
| 2007 | 143.5 | 1254.17 | 509.3 | 28.17 | 11.44 | 4.966335035 | 7.134229278 |
| 2008 | 199.5 | 1503.06 | 709.0 | 28.13 | 13.27 | 5.295814236 | 7.315258309 |
| 2009 | 287.9 | 1654.21 | 988.3 | 29.14 | 17.41 | 5.662613198 | 7.411078832 |
| 2010 | 467.8 | 2064.50 | 1317.0 | 35.53 | 22.66 | 6.148040854 | 7.632643345 |
| 2011 | 663.1 | 2522.66 | 1673.5 | 39.62 | 26.28 | 6.496925808 | 7.833069179 |
| 2012 | 886.6 | 2855.54 | 2145.4 | 41.33 | 31.05 | 6.787393922 | 7.957016246 |
| 2013 | 1196.8 | 3177.56 | 2725.4 | 43.91 | 37.66 | 7.087406607 | 8.063868886 |
| 2014 | 1431.7 | 3500.72 | 3039.5 | 47.10 | 40.89 | 7.266617828 | 8.160723941 |
| 2015 | 1703.9 | 3702.76 | 3355.4 | 50.78 | 46.02 | 7.44067502 | 8.216833766 |

Note: Real estate investment is the completion of real estate investment this year; The unit is RMB 100 million. Data from (Hainan Statistical Yearbook 2006 ~2016).
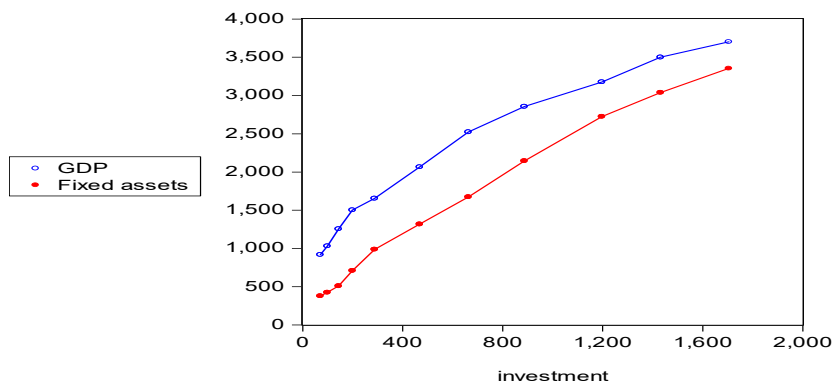


Fig. 1 The relationship between real estate investment, GDP and fixed assets investment 2005-2015

According to the data collected in (Hainan Statistical Yearbook 2006 ~2016). The graph shows that real estate investment, fixed asset investment and GDP both show a linear relationship of steady rising trend, which reflects the sustained and stable development trend of Hainan real estate

enterprises from 2005 to 2015. And reflects the real estate investment to the national economy growth has the long-term dynamic equilibrium influence. the growth of real estate investment depends on fixed asset investment and the sustained and stable growth of GDP, which has created a good environment, which also brings sufficient confidence to the development of real estate. Thus, Hainan real estate investment and the sustained growth of the national economy is interrelated.

## 3. Empirical Analysis: Real Estate Investment and Economic Growth

### 3.1 Unit Root Test

Most of the time series in real economic problems are non-stationary time series, which can not be directly used to construct econometric models. In order to avoid the unsteady data, the proposition of "pseudo regression" is usually produced.In this paper, the ADF test method proposed by Dickey and Fuller is used to test the stability of

$\ln(Y), \ln(X), \quad \Delta \ln(Y) 、 \Delta \ln(X)$ and $\Delta^2 \ln(Y) 、 \Delta^2 \ln(X)$

Table 2. ADF test results of each index sequence

| Order | ADF value | P | Critical value | | | Inspection results |
|---|---|---|---|---|---|---|
| | | | 1% | 5% | 10% | |
| $\ln(Y)$ | −0. 124768 | 0. 9818 | −5. 295384 | −4. 008157 | −3. 460791 | Unsteady |
| $\ln(X)$ | −0. 111618 | 0. 9918 | −5. 295384 | −4. 008157 | −3. 460791 | Unsteady |
| $\Delta \ln(Y)$ | −2. 804184 | 0. 2345 | −5. 521860 | −4. 107833 | −3. 515047 | Unsteady |
| $\Delta \ln(X)$ | −1. 879631 | 0. 5859 | −5. 521860 | −4. 107833 | −3. 515047 | Unsteady |
| $\Delta^2 \ln(Y)$ | −4. 009949 | 0. 0924 | −7. 006366 | −4. 773194 | −3. 877714 | Steady |
| $\Delta^2 \ln(X)$ | −3. 174997 | 0. 0060 | −6. 292057 | −4. 450425 | −3. 701534 | Steady |

Description: $\Delta, \Delta^2$ are first order difference and second order difference respectively

Table 2 reflects the unit root test results of the real estate investment and economic growth indicators of Hainan Province, from which we can see their absolute values of their ADF test statistics are larger than the absolute values of their critical values in the case of 1% or 10% of ADF test, indicating that they all have unit roots and are non-stationary sequences.

### 3.2 Cointegration Test——Engle-Granger

The first step is cointegration regression (OSL method). By using the least square method, the regression analysis of lnY、lnX from 2005 to 2015 was carried out to test the cointegration relationship between variables, and to estimate the parameters of the long-term equilibrium relationship. The following equations were obtained:

$$\ln Y = 0.444756 \ln X + 4.921091 + \varepsilon_i \tag{2}$$

t (69.68041)　　　(126.5223)

p (0.0000)　　(0.0000)

The regression results show that the goodness of fit of the model is good, and both of them pass t test and p test.

The second step is to test whether the residuals are stationary sequences.

The unit root test is carried out according to the residual terms obtained from equation 3-1, and the results are as follows:

Table 3. Results of unit root test of residual terms

|  |  | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic |  | -4.826590 | 0.0217 |
| Test critical values: | 1% level | -5.521860 |  |
|  | 5% level | -4.107833 |  |
|  | 10% level | -3.515047 |  |

According to the results of Table 3, the residual term passes the unit root test at 5% level, that is, the original sequence is cointegrated at the significant level of 5%, and the original hypothesis can be rejected, and the residual sequence is considered to be stable. That is to say, the long-term regression equation can be established, and the existence and stationary linear combination, that is, there is a long-term dynamic equilibrium relationship between investment in real estate development and economic growth in Hainan Province from 2005 to 2015.

### 3.3 Error Correction Model

Due to the co-integration of $\ln Y$、$\ln X$ in the original sequence, it is necessary to establish an error correction model to reflect the long-term equilibrium and short-term volatility between variables. According to equation 3-1, the ECM model can be established as follows:

Table 4. Residual regression results

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| LNY | 2.234021 | 0.040978 | 54.51772 | 0.0000 |
| ECM(-1) | 0.534537 | 0.837000 | 0.638634 | 0.5434 |
| C | -10.95350 | 0.314561 | -34.82157 | 0.0000 |

R-squared=0.997665, Adjust R-squared=0.996998, F-statistic=1495.610, D-W=2.127035.

The model results show that the fluctuation of $\ln Y$ is directly affected by the short-term fluctuation of $\ln X$. The coefficient of ecm (-1) in the model reflects the correction degree of the deviation from equilibrium relationship between real estate development investment and GDP in the previous year. The coefficient is -0.235439, which accords with the reverse correction mechanism and $\Delta \ln Y$ is increasing. Although the determination coefficient is low, the overall significance of the model is satisfied and the statistics of each coefficient t test are significant, which can indicate the economic meaning of the model.

### 3.4 Granger Causality Test

It is proved by cointegration test that there is a long-term equilibrium relationship between real estate development investment and economic growth in Hainan Province, but it is not clear whether the two variables are single causality or mutual causality. In order to further comb the relationship between the two and consider the particularity of real estate investment comprehensively, this paper chooses the lag period as 2, The results of Granger causality test for $\ln Y$、$\ln X$ are shown in Table 5.

Table 5. Granger causality test results

| Null hypothesis | Lag order | Sample book | F statistical quantity | P | Inspection results |
|---|---|---|---|---|---|
| $\ln Y$ does not Granger Cause $\ln X$ | 2 | 9 | 1.87528 | 0.2664 | Accept |
| $\ln X$ does not Granger Cause $\ln Y$ |  |  | 12.2771 | 0.0196 | refuse |

As table 5 shows, that is, when there is a delay of two periods, it is accepted the original hypothesis of "$\ln Y$ does not Granger Cause $\ln X$"And refused "$\ln X$ does not Granger Cause $\ln Y$".The growth of real estate investment is the reason of economic growth, economic growth does not necessarily lead to the growth of real estate investment.

## 4. Conclusion

Based on the data of Hainan Province from 2005 to 2015, this paper studies the relationship between real estate investment and economic growth by using unit root test, cointegration test, error correction model and Granger causality test.The main results are as follows:

(1) There is a long-term dynamic equilibrium relationship between real estate investment and economic growth in Hainan Province.The results of cointegration test show that every increase of investment in real estate investment and development will promote the GDP growth of economic growth by 0.444756, which indicates that healthy investment in real estate development contributes to the development of regional economy.

(2) The fluctuation of Hainan economic growth can be divided into two parts: short-term fluctuation and long-term equilibrium. The long-term effect of real estate investment on economic growth is more significant than that in the short term. The error correction coefficient in model (3-2) is -0.235439, which accords with the reverse correction mechanism.

(3) There is a one-way causal relationship between real estate investment and economic growth in Hainan Province. The results of Granger test show that when the lag is 2, the growth of real estate investment is considered to be the cause of economic growth. Economic growth does not necessarily lead to real estate investment growth.

(4) Real estate investment plays a special role in the process of urbanization, so the relationship between real estate investment and economic growth should be clearly understood. According to the present situation and orientation of urban development, we should reasonably determine the scale of real estate development investment and its proportion in fixed assets investment, avoid relying too much on real estate investment to achieve economic growth, and realize the healthy economic development in a multi-channel and multi-path way. At the same time, we should enrich the direction of economic development, thus effectively promote the further development of our social economy.

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