The Impact of Real Estate Investment on Economic Growth: Empirical Studies from 31 Chinese Provinces (2006–2016)

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Abstract It's of great significance for social development to explore the true impact of real estate investment on economic growth. This paper selects the data of real estate investment, other investment, consumption and exports in 31 provinces (municipalities and autonomous regions) from 2006 to 2016 for empirical analysis. It uses the unit root test and co-integration test to establish a panel data model and obtain a linear regression equation. The research results indicate that real estate investment can promote economic growth, but the promotion is not great. Specifically, the impact factors of China's real estate investment, other investment, consumption and exports on economic growth are: 0.065, 0.089, 0.641 and 0.042, respectively. The impact on economic growth is positive, and the impact effects are significant.

Keywords Economic growth · Real estate investment · Other investment · Consumption · Exports

1 Introduction

Since China's reform and opening up in 1978, China's economy has developed rapidly, but the economic growth model is still relying on the extensive model of resource input, lacking intensive economic growth to improve production efficiency, specifically manifested by macro growth and micro inefficiency. As shown in Fig. 1, since the beginning of the twenty-first century, China's GDP has maintained a growth rate of more than 6% year by year, and by 2016, China's GDP has reached 74,006.08 billion yuan [1].

There are many factors affecting China's economic growth, especially as the "troika" that drives economic growth—investment, consumption, and exports—the impact of these three factors on economic growth has always been a hot topic in the macroeconomic field. A lot of meaningful analysis and research have been done by many scholars, who generally believe that consumption and investment have positive

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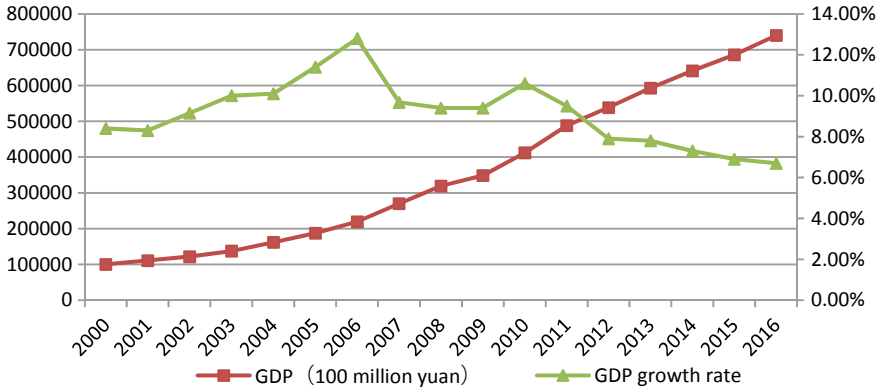

Fig. 1 China's GDP and GDP growth rate from 2000 to 2016. *Source* China Statistical Yearbook (in 2000–2016 years)

effects on China's economic growth. However, with the reform of China's economic system and economic structure, the impact of current investment, consumption and exports on economic growth needs to be demonstrated.

As an important part of fixed asset investment, real estate investment has become an important factor to promote the sustained growth of China's economy [2]. However, in recent years, real estate investment has been in a "high temperature" state and the development of real estate investment is too fast, which makes more and more people deeply troubled by the abnormal development of the real estate industry, causing excessive housing prices and rising problems. As Hongyu and Park [3] have pointed out that excessive dependence on real estate investment to promote economic growth may damage the stability and health of the national economy. However, Zhang and Wang [4] believe that real estate investment will not have a significant impact on economic growth when GDP per capita is less than $1000. According to the statistics of the National Bureau of Statistics, China's per capita GDP is 16,738 yuan in 2006, which has already exceeded 1,000 US dollars, so what is the impact of real estate investment on economic growth today? This paper attempts to select the panel data of 31 Chinese provinces from 2006 to 2016 for empirical analysis, and incorporate other factors such as investment, consumption and exports, so as to explore the role of real estate investment in economic growth when coexisting with other factors. At the same time, this paper can also explore the important impact factors driving the economic growth of China in the sample interval, which can show the changing trend of China's economic growth pattern.

2 Literature Review

Regarding real estate investment and economic growth, it has always been an important research field, and many scholars have conducted in-depth research on this topic. Liu et al. [5] analyzed the share of real estate in total output, value added and gross national product (GDP), highlighting the role of real estate in economic growth. Gholipour and Al-mulali [6] used panel co-integration technology to test that FDI in the real estate sector of OECD countries will not lead to real estate prices, nor will it promote economic growth. Gholipour [7] used the panel var model to empirically study the impact of foreign real estate investment (FREI) in emerging economies on housing prices. The study found that the main source of house price fluctuations in emerging economies come from the real estate market itself. de Melo [8] selected the price data of Ceara from 2007 to 2010 for co-integration test and ADF test. The results show that there is a co-integration relationship between the average selling price per square meter and the average construction cost per square meter. Wang et al. [9] used panel data to establish an econometric model, who empirically found that for every 1% increase in urban economic openness, real estate prices will rise by 0.282%. During the sample period, the urban economic openness alone accounted for about 15.90% of China's real estate prices. Aizenman Jinjarak [10] studied the relationship between current account and real estate valuations. They find a robust and strong positive correlation between the current account deficit and the real estate price/ (GDP deflator) appreciation. Yunfang and Tiemei [11] empirically studied the regional differences in real estate price volatility in China by establishing a panel data model. The results show that credit policy has a greater impact on the eastern and western regions, and has little impact on the middle region; per capita GDP has a greater impact on the real estate market in the middle region. Yue and Hongyu [12] analyzed the interaction between real estate investment and economic growth through Granger causality test, considering that economic growth has a significant one-way effect on real estate development investment in China. Hong [13] uses the GMM method to estimate the correlation between real estate investment and economic growth, who think that the impact of China's real estate investment on economic growth from 1994 to 2010 was positive and strong in the short term, while the long -term performance was negative.

Throughout the literature, we found that few scholars have comprehensively considered the impact of real estate investment, other investment, consumption and exports on economic growth. Therefore, this paper incorporates four factors of real estate investment, other investment, consumption and exports, comprehensively considers these important factors affecting economic operation, and focuses on the real impact of real estate investment on economic growth when coexisting with other factors, which makes the related research improved and enriched in theory. This paper selects the panel data of 31 Chinese provinces (municipalities and autonomous regions) from 2006 to 2016, and uses the unit root test and co-integration test to establish a linear regression model of GDP and real estate investment, other investment, consumption and exports of municipalities directly under the central government,

so we can obtain the influence coefficient of four factors intuitively, and explore the true influence of the four factors on economic growth.

3 Research Data and Method

3.1 Research Data

This paper comprehensively selects four research indicators of real estate investment, other investment (the total investment of fixed assets minus the value of real estate investment), consumption and exports. The analysis data of these four research indicators are taken from the 31 provinces of China Statistical Yearbook (city, Autonomous Region) Data for 2006 to 2016. Among them, the GDP is selected to measure economic growth; the real estate investment is used to measure real estate investment; the total investment of fixed assets minus the value of real estate investment completion is used to measure other investments; the total retail sales of social consumer goods is used to measure consumption; export is measured by the total export value of the goods. All the above data are sourced from the China Statistical Yearbook.

3.2 Research Method

3.2.1 Model Setting

The Cobb–Douglas production function is widely used in the study of econometrics. This paper expands the Cobb–Douglas production function to create a panel data model for economic growth, real estate investment, other investment, consumption, and exports.

To eliminate the effects of heteroscedasticity, take the logarithm of the variables and build the panel data model as follows:

$$\ln\mathrm{GDP} = \mathrm{C} + \beta_1 \ln REI + \beta_2 \ln OI + \beta_3 \ln OG + \beta_4 \ln VOE$$

Among them, GDP is gross domestic product, which is used to measure economic growth; REI is the amount of real estate investment completed; OI is the amount of other investment (the total investment of fixed assets minus the value of real estate investment); OG is the total retail sales of consumer goods; VOE is the total export value of goods; β_1 represents the elasticity coefficient between real estate investment and economic growth; β_2 represents the elasticity coefficient between other investments and economic growth; β_3 represents the elasticity coefficient between consumption and economic growth; β_4 represents the elastic coefficient between

exports and economic growth, and all data sources in this paper are from China Statistical Yearbook.

3.2.2 Model Testing

The unit root test is required before the panel data model is estimated. The unit root test is the stationarity test to check whether the data is stable, whose main unit root test methods are: LLC test (1992, 1993); IPS test (2003), Fisher-ADF test and Fisher-PP test, etc.

For the non-stationary panel data, it is necessary to perform co-integration test to check whether the data has a co-integration relationship. There are two categories co-integration test methods: one is based on regression residuals, the other is based on maximum likelihood ratio. For example, the pedroni test (1999) and the Kao test (1999) belong to the former method; the Johansen Fisher co-integration test (1999) belongs to the latter method. It should be noted that the precondition for the co-integration test is that all data are stationary at the same order, and the object is the original data.

3.2.3 Model Selection

Before the panel data model estimation, the type of panel data model should be determined. The panel data analysis model is mainly divided into two types: one is the fixed effect model and the other is the random effect model. We can determine the choice of the model by Hausman test on the panel data. The basic idea of the Hausman test is to compare the parameter estimation results of the two models and determine whether there is a difference, if there is a difference, we can select the fixed effect model; if not differences are selected, we should choose the random effect model for estimation. It is worth noting here that we should perform random effect estimation before the Hausman test.

4 Results

4.1 Unit Root Test

According to Sect. 3.2.2, we try to use the four test methods of LLC, IPS, Fisher-pp and Fisher-ADF to carry out the unit root test. The original hypothesis of the four test methods is that there is a unit root. If the test sequence has a unit root, it indicates that the panel data is unstable. At this point, you need to perform differential processing and perform the unit root test again. With the help of Eviews7.2 software, the unit

root test is carried out on the five panel data of lnGDP, lnREI, lnOI, lnOG and lnVOE, and the test results are summarized in Table 1.

It can be seen from the test results that the values of lnGDP, lnREI, lnOI, lnOG, and lnVOE cannot be tested by LLC, IPS, Fisher-PP, and Fisher-ADF, and all of them are accepted as null hypothesis, which is considered to be non-stationary. As a result, the original sequence data of the five panel data of lnGDP, lnREI, lnOI, lnOG, and lnVOE needs to be differentially processed, in other words, the unit root test should be performed on the first-order difference form of the data. From the test results, we can see that the first-order difference of lnGDP, lnREI, lnOI, lnOG, and lnVOE can be tested by LLC, IPS, Fisher-PP and Fisher-ADF, and the null hypothesis is rejected.

Therefore, the sequences of lnGDP, lnREI, lnOI, lnOG, and lnVOE are all first-order stationary, and co-integration tests can be performed.

4.2 Co-integration Test

According to Sect. 3.2.2, this paper attempts to use the Pedroni test method for co-integration test. With the help of Eviews7.2 software, the Pedroni method is used for co-integration, and the test results are summarized in Table 2.

Since the time span of data selected in this paper is 11, T < 20, which belongs to small sample data. Pedroni (2001) has shown that under small sample, the method Panel ADF-Statistic and Group ADF-Statistic test works best [14]. Therefore, from the results of Panel ADF-Statistic and Group ADF-Statistic test in Table 2, it can be seen that lnGDP and lnREI, lnGDP and lnOI, lnGDP and lnOG, lnGDP and lnVOE reject the null hypothesis at 5% confidence level, so we can consider that there is a co-integration relationship among the sequences, which can be used to estimate the panel data model.

4.3 Model Estimation and Analysis

Based on Sect. 3.2.3, we first estimate the random effects of the panel data through Eviews7.2 software, and then perform the Hausman test, as is shown in Table 3.

The null hypothesis of the Hausman test is that the individual effect is independent of the regression variable and is suitable for the random effect model; otherwise, the fixed effect model is chosen. It can be seen from the test results in Table 3 that the p value is 0.0000 and less than 5%, and the null hypothesis should be rejected. Therefore, this paper should select the fixed effect model for the panel data estimation. The model estimation results of the panel data are shown in Table 4.

$$\ln\mathrm{GDP} = 2.493 + 0.065\ln REI + 0.089\ln OI + 0.641\ln OG + 0.042\ln VOE$$

Table 1 Unit root test results

Variable	Level value				1st difference			
	LLC	IPS	Fisher-pp	Fisher-ADF	LLC	IPS	Fisher-pp	Fisher-ADF
lnGDP	0.2442 (−0.6927)	1.0000 (7.6516)	1.0000 (22.9337)	1.0000 (10.9967)	0.0000 (−13.1955)	0.0541 (−1.6062)	0.0000 (168.810)	0.0025 (97.8389)
lnREI	0.4902	0.9999	0.8163	0.9808	0.0000	0.0410	0.0000	0.0004
	(−0.0246)	(3.6685)	(51.8927)	(41.1866)	(−10.5710)	(−1.7398)	(159.451)	(106.051)
lnOI	0.0113 (−2.2791)	1.0000 (4.0732)	0.6019 (−58.5209)	0.9847 (40.4211)	0.0000 (−13.5946)	0.0066 (−2.4810)	0.0000 (194.657)	0.0000 (134.810)
lnOG	1.0000 (4.8832)	1.0000 (9.6746)	1.0000 (0.3962)	1.0000 (2.2593)	0.0000 (−23.9176)	0.0000 (−7.3550)	0.0000 (404.851)	0.0000 (231.879)
lnVOE	(−5.6970) 0.000	(0.0498) 0.5198	(68.4339) 0.2682	(61.4426) 0.4961	(−13.4022) 0.0000	0.0101 (−2.3226)	0.0000 (194.299)	0.0000 (116.942)

Note The data outside the parentheses indicates the p-value, and the data in parentheses indicates the t-value

Table 2 Co-integration test results

Statistics	lnGDP and lnREI	lnGDP and lnOI	lnGDP and lnOG	lnGDP and lnVOE
Panel v-Statistic	0.0000 (22.5402)	0.0003 (3.4511)	(2.0929) 0.0182	(−2.2605) 0.9881
Panel rho-Statistic	0.9564 (1.7099)	0.9996 (3.3446)	(3.7778) 0.9999	(−1.6413) 0.0504
Panel PP-Statistic	0.0000 (−4.8916)	0.2156 (−0.7871)	(−7.4544) 0.0000	(−2.3023) 0.0107
Panel ADF-Statistic	0.0000 (−6.0871)	0.0001 (−3.8116)	(−12.2300) 0.0000	(−2.7277) 0.0032
Group rho-Statistic	1.0000 (4.2861)	1.0000 (5.3615)	(5.4893) 1.0000	(2.5918) 0.9952
Group PP-Statistic	0.0000 (5.0776)	0.2545 (−0.6604)	(−10.3301) 0.0000	(−1.1804) 0.0356
Group ADF-Statistic	0.0000 (−8.8213)	0.0000 (−3.9476)	(−17.3263) 0.0000	(−1.9061) 0.0283

Note The data outside the parentheses indicates the p value, and the data in parentheses indicates the t value

Table 3 Hausman test

Test summary	Chi-Sq. Statistic	Chi-Sq. d.f	Prob
Cross-section random	40.0140	4	0.0000

Table 4 Panel data model estimation results

Variable	Coefficient	Std. Error	t-Statistic
C	2.493^{***}(0.000)	0.069315	35.96983
lnREI	0.065^{***}(0.000)	0.013763	4.709134
lnOI	0.089^{***}(0.000)	0.019606	4.481802
lnOG	0.641^{***}(0.000)	0.024143	26.55633
lnVOE	0.042^{***}(0.000)	0.009411	4.414401

Note The data in parentheses indicate the p value, *p < 0.1, **p < 0.05, ***p < 0.01

$R^2 = 0.9976$ F = 3775.736 P = 0.000.

It can be seen from the above results that the judgment coefficient is R^2 tends to 1, and the goodness of fit is high, indicating that the model can explain the relationship between real estate investment, other investment, consumption, exports and economic growth; F value is very large, and it means that the residual is small and the precision is high, which indicates that the overall linear relationship of the constructed model is significant; P = 0.000 < 0.01, indicating that all the coefficient combinations obtained based on the 31 provincial panel data are highly significant. Through Table 4, we can see that the contribution rate of real estate investment to economic growth is 0.065, and the significant hypothesis of 0.01 is adopted, indicating that real estate investment

has a driving effect on economic growth, and the impact is extremely significant; other investments is 0.089 for economic growth, and the significant hypothesis of 0.01 is adopted, indicating that other investments are positively correlated with economic growth, and the impact is extremely significant; the contribution rate of consumption to economic growth is 0.641, which has passed the significant hypothesis of 0.01, indicating that consumption not only has a great effect on economic growth, but also has a significant impact effect; the contribution rate of exports to economic growth is 0.042, and the significant hypothesis of 0.01 is adopted, indicating that the contribution rate of exports to economic growth is small, but the impact is significant.

5 Conclusion

This paper examines the impact of China's real estate investment, other investments, consumption and exports on economic growth from 2006 to 2016, and draws the following conclusions:

1. In the past 10 years, the impact coefficients of real estate investment, other investment, consumption and exports on economic growth were 0.065, 0.089, 0.641 and 0.042, respectively, and all passed the significant hypothesis test of 0.01, indicating real estate investment and other Investment, consumption, and exports all have positive effects on economic growth, and the effects are significant.
2. By comparing the impact coefficient of real estate investment and other investment on economic growth, we find that real estate investment has less impact on economic growth than other investments. This conclusion is different from the conclusions of Hongyu and Park [3], who believe that the impact of real estate investment on economic growth is greater than that of non-real estate investment, and the real estate investment is an important reason for economic growth.
3. There is a big difference in the promotion of investment, consumption and exports to economic growth. Consumption has the largest contribution rate to economic growth, investment is second, and the contribution rate of exports is the smallest, indicating that China's economic development is moving from investment, export-driven to consumption-driven. This conclusion supports the research conclusions of Zhu [15], who points out that the role of Chinese exports and investment in economic growth is dynamic, which means that China's growth model changes over time.

However, some limitations exist in this research. First, the impact factors included in this paper may not be fully considered. Secondly, this paper only studies the impact of China's real estate investment, other investment, consumption and exports on economic growth. The influence of different regions can be considered in further research.

References

1. National Bureau of Statistics of China. (2019). https://data.stats.gov.cn/ks.htm?cn=C01.
2. Shun, P., & Kangping, W. (2004). The causality between real estate market development and economic growth-an empirical analysis to China. *Management Review., 3,* 1.
3. Hongyu, L., Park, Y. W., & Siqi, Z. (2002). The interaction between housing investment and economic growth in China. *International Real Estate Review., 5*(1), 40–60.
4. Zhang, J., Wang, J., & Zhu, A. (2012). The relationship between real estate investment and economic growth in China: A threshold effect. *The Annals of Regional Science, 48*(1), 123–134.
5. Liu, C., Song, Y., & Langston, C. (2005). Economic indicator comparisons of international real estate sectors using the OECD input-output database. *International Journal of Construction Management, 5*(1), 59–75.
6. Gholipour, H. F., Al-mulali, U., & Mohammed, A. H. (2014). Foreign investments in real estate, economic growth and property prices: Evidence from OECD countries. *Journal of Economic Policy Reform, 17*(1), 33–45.
7. Gholipour, H. F. (2013). The effect of foreign real estate investments on house prices: Evidence from emerging economies. *International Journal of Strategic Property Management, 17*(1), 32–43.
8. De Melo, M. M. (2013). Is there bubble price in the real estate of Ceará? *A Post-Keynesian Approach. Transnational Corporations Review, 5*(4), 96–103.
9. Wang, S., Yang, Z., & Liu, H. (2011). Impact of urban economic openness on real estate prices: Evidence from thirty-five cities in China. *China Economic Review, 22*(1), 42–54.
10. Aizenman, J., & Jinjarak, Y. (2009). Current account patterns and national real estate markets. *Journal of Urban Economics, 66*(2), 75–89.
11. Yunfang, L., & Tiemei, G. (2007). Empirical analysis on real estate price fluctuation in different provinces of China. *Economic Research Journal, 8,* 133–142.
12. Shen, Y., & Liu, H. (2004). Relationship between real estate development investment and GDP in China. *Journal-Tsinghua University, 44*(9), 1205–1208.
13. Hong, L. (2014). The dynamic relationship between real estate investment and economic growth: Evidence from prefecture city panel data in China. *IERI Procedia, 7,* 2–7.
14. Pedroni P. (2001). *Fully modified OLS for heterogeneous cointegrated panels. Nonstationary panels, panel cointegration, and dynamic panels* (pp. 93–130). Emerald Group Publishing Limited.
15. Zhu, A., & Kotz, D. M. (2011). The dependence of China's economic growth on exports and investment. *Review of Radical Political Economics, 43*(1), 9–32.