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Empirical Research on the Impact of Real Estate on Economic Development

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Abstract

Real estate development investment has a significant impact on economic development. Based on data from 17 prefecture-level cities and prefectures in Hubei Province from 2002 to 2018, the relationship between real estate development investment and economic growth is analyzed with the help of panel data models. The study found that there is a long-term equilibrium relationship between the two, and there are regional differences in the impact of real estate development investment on economic growth in Hubei Province. Among them, Wuhan has the largest impact and Shennongjia forest area has the smallest impact. The impact of real estate development investment on economic growth depends on the level of regional economic development.

Keywords

Real Estate, Economic Growth, Panel Data Model

1. Introduction

The real estate industry has been on the rise for many years. In recent years, despite the slowdown in the development of the real estate industry across the country, various provinces and cities have introduced various new housing policies in order to attract talent. It can be seen that, whether it is the direct impact of the real estate industry on economic growth in the past few decades or the indirect impact of the real estate industry on economic growth in recent years, it shows that the real estate industry is an important long-term effective factor for economic growth. Therefore, many scholars [1] [2] [3] [4] [5] discussed the relationship between real estate development investment and economic growth, mainly using the following two methods: the first is to discuss the cause and effect of real estate development investment and economic growth based on Granger causality test [6] relationship; the second is to use time series data to

establish a vector autoregressive (VAR) model [6] to study the interactive relationship between real estate development investment and economic growth. This paper uses panel data to establish a fixed-effect variable coefficient model [7] to conduct an empirical analysis of the relationship between real estate development investment and economic growth in 17 prefecture-level cities and prefectures in Hubei Province from 2002 to 2018.

2. Empirical Analysis

2.1. Data Description

This article selects the annual data of cities and states in Hubei Province from 2002 to 2018. The gross product of each city and state is taken as the explanatory variable and expressed by GDP. The investment scale of real estate development, infrastructure investment scale and technological transformation investment scale of each city and state are taken as the explanatory variable and expressed by REI, INF and TEC respectively. Before establishing the model, we perform a natural logarithmic transformation on each data, which can both eliminate heteroscedasticity and make the data series more stable. The data comes from Hubei Statistical Yearbook.

2.2. Unit Root Test

To prevent false regression or false regression, we use LLC, IPS, ADF, PP-Fisher four test methods to analyze the stability of the data, as shown in Table 1.

Table 1. Unit root test of panel data.

Variable	LLC test	IPS test	ADF test	PP-Fisher test
LnGDP	−0.34424 (0.3653)**	5.07864 (1.0000)**	8.37431 (1.0000)**	6.93169 (1.0000)**
ΔLnGDP	−25.3064 (0.0000)**	−12.5603 (0.0000)**	125.554 (0.0000)**	134.834 (0.0000)**
LnREI	−5.09708 (0.0000)**	0.18295 (0.5726)**	28.8456 (0.6270)**	49.1685 (0.0268)**
ΔLnREI	−8.79931 (0.0000)**	−7.50299 (0.0000)**	114.362 (0.0000)**	130.928 (0.0000)**
LnINF	−2.96376− (0.0015)**	2.69346 (0.9965)**	19.6971 (0.9761)**	13.7760 (0.9992)**
ΔLnINF	−7.48415 (0.0000)**	−5.89356 (0.0000)**	96.1887 (0.0000)**	98.6457 (0.0000)**
LnTEC	−1.46581 (0.0713)**	1.69675 (0.9551)**	17.0436 (0.9932)**	18.4390 (0.9863)**
ΔLnTEC	−8.53638 (0.0000)**	−8.28401 (0.0000)**	133.847 (0.0000)**	125.490 (0.0000)**

Note: Δ means first-order difference; **means significance level of 5%.

As can be seen from the table above, the horizontal sequence of LnGDP, LnREI, LnINF and LnTEC cannot reject the null hypothesis that unit roots exist at a significant level of 5%. However, the P values of the ΔLnGDP, ΔLnREI, ΔLnINF and ΔLnTEC sequences after the first-order difference are all 0, that is, the null hypothesis is rejected, indicating that the first-order difference sequence of the sequence is stable.

2.3. Panel Data Cointegration Test

Because the sequence ΔLnGDP, ΔLnREI, ΔLnINF and ΔLnTEC are all I(1) sequences, the conditions of the cointegration test are satisfied. And the first-order difference sequences of the four variables are all stable, meeting the premise of the co-integration test. In order to ensure the accuracy, the author uses the Pedroni test, Kao test, and Combined Individual test to verify at the same time. The original hypothesis of these three tests is that there is no co-integration. The test results are shown in Table 2.

The results in Table 2 indicate that at the significance level of 5%, the P statistics of Panel PP-Statistic, Panel ADF-Statistic, Group PP-Statistic, and Group ADF-Statistic of the Pedroni test are all 0, and most of the test results are rejected. The null hypothesis indicates the existence of cointegration. However, the other three statistics of the Pedroni test showed no co-integration. Therefore, in order to ensure accuracy, Kao test and Combined Individual test are needed to verify. As can be seen from the above table, the P statistic of the Kao test is less than 5%, the null hypothesis of no co-integration is rejected, and the three hypotheses of the joint individual test are rejected. This shows that from 2000 to

Table 2. Co-integration test results of 17 prefecture-level cities and prefectures in Hubei Province.

Statistical methods	Statistics	
Pedroni Test	Panel v-Statistic	−25.85242 (1.0000)
	Panel rho-Statistic	−1.318870 (0.0936)
	Panel PP-Statistic	−7.216089 (0.0000)
	Panel ADF-Statistic	−7.980418 (0.0000)
	Group rho-Statistic	2.161981 (0.9847)
	Group PP-Statistic	−4.032946 (0.0000)
	Group ADF-Statistic	−5.359391 (0.0000)
Kao Test	ADF	−2.899656 (0.0019)
Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Fisher Stat.* (from max-eigen test)
None	395.9 (0.0000)	256.5 (0.0000)
At most 1	193.8 (0.0000)	128.9 (0.0000)
At most 2	104.6 (0.0000)	69.87 (0.0001)
At most 3	98.31 (0.0000)	98.31 (0.0000)

2016, there was a long-term stable and balanced relationship between investment in housing development, investment in infrastructure construction, and investment in technological transformation and GDP in Hubei Province.

2.4. Panel Model Selection

2.4.1. Random Effect and Fixed Effect Test

Likelihood ratio (LR) test is a test of the model's fixed effect. The null hypothesis of this test is that the fixed effect is redundant. From the results in Table 3, it can be clearly seen that the null hypothesis is rejected under the 5% confidence level That is, the fixed effects introduced are appropriate.

2.4.2. F-Test of Panel Model

Through calculation, we can get $F_2 = 21.77706$, $F_2 = 8.35356$. Given the significance level of $\alpha = 5\%$, we can know that $F_{2\alpha}(60,208) = 1.7$, $F_\alpha(45,208) = 1.39$. Because $F_2 > 1.7$, H_2 is rejected; and $F_1 > 1.39$, H_1 is rejected. Therefore, a fixed effect variable coefficient model should be established.

2.4.3. Regression Estimation of Panel Model

Based on the panel model's F-test and likelihood ratio (LR) test results, we establish a fixed-effect variable coefficient model for panel data from 17 cities and states in Hubei Province: $\mathrm{LnGDP} = \alpha + \beta_1 \mathrm{LnREI} + \beta_2 \mathrm{LnINF} + \beta_3 \mathrm{LnTEC}$. Eviews7.2 was used to estimate the model, and the results are as follows:

Table 4 and Table 5 show the results of applying fixed-effect variable coefficient models to the data of 16 prefecture-level cities in Hubei Province, as well as the results of goodness of fit, statistics, and statistics of regression equations.

As can be seen from the table, the estimated value of the explanatory variable at a significant level of 1% is valid, the goodness of fit R^2 is above 99%, and the P value of the F statistic is 0. The value of D.W. is near 2, which indicates that cross-section SUR is used to weight the explanatory variables to effectively reduce the effect of cross-section data on heteroscedasticity and correlation over the same period.

According to Table 6, from 2002 to 2018, for every 1% increase in real estate development investment in Wuhan, GDP can increase by 0.76%. The coefficient of real estate development investment in Wuhan is greater than the coefficient of infrastructure investment and technological transformation investment, indicating that production in Wuhan The total value relies heavily on real estate development investment. At the same time, the real estate development investment in Jingmen, Yichang, Xiantao, Jingzhou, Xiangyang, Enshi and Xiaogan has a positive effect on GDP. Then the investment coefficient of real estate development in these areas gradually decreases, and infrastructure investment tends to

Table 3. Likelihood ratio (LR) test results of panel data.

Effects Test	Statistic	d. f.	Prob.
Cross-section F	167.739471	(15,208)	0.0000

Table 4. Regression estimation results of the fixed effect variable coefficient model.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.893797	0.036497	106.6871	0.0000
_WUHAN--LNREI_WUHAN	0.767510	0.029072	26.40022	0.0000
_HUANGSHI--LNREI_HUANGSHI	−0.074545	0.028181	−2.645229	0.0088
_SHIYAN--LNREI_SHIYAN	−0.123605	0.011623	−10.63420	0.0000
_YICHANG--LNREI_YICHANG	0.238224	0.015091	15.78616	0.0000
_XIANGYANG--LNREI_XIANGYANG	0.061494	0.016581	3.708735	0.0003
_EZHOU--LNREI_EZHOU	−0.487179	0.068315	−7.131344	0.0000
_JINGMEN--LNREI_JINGMEN	0.637393	0.034066	18.71029	0.0000
_XIAOGAN--LNREI_XIAOGAN	0.014907	0.015527	0.960084	0.3381
_JINGZHOU--LNREI_JINGZHOU	0.099174	0.008775	11.30233	0.0000
_HUANGGANG--LNREI_HUANGGANG	−0.238633	0.049267	−4.843672	0.0000
_XIANNING--LNREI_XIANNING	−0.009465	0.003580	−2.643740	0.0088
_SUIZHOU--LNREI_SUIZHOU	−0.060376	0.009499	−6.356215	0.0000
_ENSHI--LNREI_ENSHI	0.014998	0.011027	1.360052	0.1753
_XIANTAO--LNREI_XIANTAO	0.208718	0.011208	18.62234	0.0000
_QIANJIANG--LNREI_QIANJIANG	−0.104010	0.018586	−5.596080	0.0000
_TIANMEN--LNREI_TIANMEN	−0.036792	0.019904	−1.848501	0.0659
_WUHAN--LNINF_WUHAN	−0.056024	0.026100	−2.146518	0.0330
_HUANGSHI--LNINF_HUANGSHI	0.434497	0.029229	14.86517	0.0000
_SHIYAN--LNINF_SHIYAN	0.533329	0.011686	45.63651	0.0000
_YICHANG--LNINF_YICHANG	0.391790	0.017531	22.34847	0.0000
_XIANGYANG--LNINF_XIANGYANG	0.375156	0.013325	28.15448	0.0000
_EZHOU--LNINF_EZHOU	0.728457	0.064925	11.21992	0.0000
_JINGMEN--LNINF_JINGMEN	0.072777	0.045336	1.605264	0.1100
_XIAOGAN--LNINF_XIAOGAN	0.303147	0.012228	24.79151	0.0000
_JINGZHOU--LNINF_JINGZHOU	0.339363	0.010867	31.22808	0.0000
_HUANGGANG--LNINF_HUANGGANG	0.383484	0.050024	7.666012	0.0000
_XIANNING--LNINF_XIANNING	0.455809	0.008218	55.46456	0.0000
_SUIZHOU--LNINF_SUIZHOU	0.360856	0.013163	27.41409	0.0000
_ENSHI--LNINF_ENSHI	0.550089	0.017115	32.14140	0.0000
_XIANTAO--LNINF_XIANTAO	0.185374	0.010219	18.13984	0.0000
_QIANJIANG--LNINF_QIANJIANG	0.451030	0.022516	20.03193	0.0000
_TIANMEN--LNINF_TIANMEN	0.393772	0.033777	11.65792	0.0000
_WUHAN--LNTEC_WUHAN	−0.063750	0.005468	−11.65869	0.0000
_HUANGSHI--LNTEC_HUANGSHI	0.094647	0.011265	8.401604	0.0000
_SHIYAN--LNTEC_SHIYAN	−0.017637	0.009164	−1.924659	0.0556
_YICHANG--LNTEC_YICHANG	0.148625	0.013657	10.88293	0.0000
_XIANGYANG--LNTEC_XIANGYANG	0.078553	0.012916	6.081914	0.0000
_EZHOU--LNTEC_EZHOU	−0.017275	0.046119	−0.374571	0.7084

Continued

_JINGMEN--LNTEC_JINGMEN	−0.333959	0.036742	−9.089352	0.0000
_XIAOGAN--LNTEC_XIAOGAN	0.122958	0.007169	17.15131	0.0000
_JINGZHOU--LNTEC_JINGZHOU	0.002828	0.010443	0.270832	0.7868
_HUANGGANG--LNTEC_HUANGGANG	0.375891	0.038444	9.777748	0.0000
_XIANNING--LNTEC_XIANNING	0.083043	0.005608	14.80787	0.0000
_SUIZHOU--LNTEC_SUIZHOU	0.112562	0.008340	13.49713	0.0000
_ENSHI--LNTEC_ENSHI	−0.005566	0.010921	−0.509620	0.6109
_XIANTAO--LNTEC_XIANTAO	0.107345	0.005973	17.97113	0.0000
_QIANJIANG--LNTEC_QIANJIANG	0.269593	0.014596	18.47091	0.0000
_TIANMEN--LNTEC_TIANMEN	−0.051777	0.022498	−2.301400	0.0224
Fixed Effects (Cross)				
_WUHAN--C	0.228206			
_HUANGSHI--C	0.113651			
_SHIYAN--C	0.256524			
_YICHANG--C	−0.883834			
_XIANGYANG--C	0.506471			
_EZHOU--C	−0.474434			
_JINGMEN--C	1.627321			
_XIAOGAN--C	0.427549			
_JINGZHOU--C	0.496782			
_HUANGGANG--C	−0.214690			
_XIANNING--C	−0.468961			
_SUIZHOU--C	0.046942			
_ENSHI--C	−0.879919			
_XIANTAO--C	0.273954			
_QIANJIANG--C	−1.094671			
_TIANMEN--C	0.039108			

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

R-squared	0.999992	Mean dependent var	−394.5155
Adjusted R-squared	0.999989	S.D. dependent var	2532.235
S.E. of regression	1.027830	Sum squared resid	219.7385
F-statistic	398771.8	Durbin-Watson stat	2.131481
Prob (F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.986690	Mean dependent var	6.225209
Sum squared resid	3.702085	Durbin-Watson stat	1.349482

Table 5. Regression estimation results of the fixed effect variable coefficient model.

Area	Fixed effect	β_1	β_2	β_3
Wuhan	0.228206	0.767510	−0.056024	−0.063750
Huangshi	0.113651	−0.074545	0.434497	0.094647
Shiyan	0.256524	−0.123605	0.533329	−0.017637
Yichang	−0.883834	0.238224	0.391790	0.148625
Xiangyang	0.506471	0.061494	0.375156	0.078553
Ezhou	−0.474434	−0.487179	0.728457	−0.017275
Jingmen	1.627321	0.637393	0.072777	−0.333959
Xiaogan	0.427549	0.014907	0.303147	0.122958
Jingzhou	0.496782	0.099174	0.339363	0.002828
Huanggang	−0.214690	−0.238633	0.383484	0.375891
Xianning	−0.468961	−0.009465	0.455809	0.083043
Suizhou	0.046942	−0.060376	0.360856	0.112562
Enshi	−0.879919	0.014998	0.550089	−0.005566
Xiantao	0.273954	0.208718	0.185374	0.107345
Qianjiang	−1.094671	−0.104010	0.451030	0.269593
Tianmen	0.039108	−0.036792	0.393772	−0.051777

Table 6. Regional differences in the impact of various investments on GDP.

Area	Impact of REI on GDP	Ranking	Impact of INF on GDP	排名	Impact of TEC on GDP	Ranking
Wuhan	0.76751	1	−0.056024	16	−0.06375	15
Jingmen	0.637393	2	0.072777	15	−0.333959	16
Yichang	0.238224	3	0.39179	8	0.148625	3
Xiantao	0.208718	4	0.185374	14	0.107345	6
Jingzhou	0.099174	5	0.339363	12	0.002828	10
Xiangyang	0.061494	6	0.375156	10	0.078553	9
Enshi	0.014998	7	0.550089	2	−0.005566	11
Xiaogan	0.014907	8	0.303147	13	0.122958	4
Xianning	−0.009465	9	0.455809	4	0.083043	8
Tianmen	−0.036792	10	0.393772	7	−0.051777	14
Suizhou	−0.060376	11	0.360856	11	0.112562	5
Huangshi	−0.074545	12	0.434497	6	0.094647	7
Qianjiang	−0.10401	13	0.45103	5	0.269593	2
Shiyan	−0.123605	14	0.533329	3	−0.017637	13
Huanggang	−0.238633	15	0.383484	9	0.375891	1
Ezhou	−0.487179	16	0.728457	1	−0.017275	12

increase. Infrastructure investment in these regions has a greater impact on GDP. However, the real estate development investment in Xianning, Tianmen, Suizhou, Huangshi, Qianjiang, Shiyan, Huanggang and Ezhou has a negative effect on GDP, while the coefficient of infrastructure investment has gradually increased. Comparing the impact coefficients of real estate development investment, infrastructure investment and technological transformation investment on GDP, it is not difficult to find that for most cities, the impact of infrastructure investment on GDP is more significant.

3. Conclusion

This paper studies the relationship between real estate development investment and economic growth in 17 prefecture-level cities and prefectures in Hubei Province using stationary test, cointegration test and panel data regression estimation. The study found that there is a long-term equilibrium relationship between real estate development investment and economic growth in Hubei province. The influence of real estate development investment on GDP in Hubei Province has a large difference. For provincial capital cities with rapid economic development, real estate development investment has promoted GDP growth. For other prefecture-level cities with slower economic development, real estate development investment has a negative correlation with GDP. The impact of real estate development investment in Shennongjia forest area on GDP is zero, and many places in this area have been included in the national ecological protection area forbidden development. In view of the above, the relevant policy recommendations are as follows: 1) Implement regional real estate control policies. Due to the regional differences in the impact of real estate development investment on GDP, a one-size-fits-all policy should be avoided to assist in the implementation of regional real estate control policies. Specifically, in areas with high levels of economic development, the scale and growth rate of real estate investment should be controlled reasonably. For regions with low economic levels, the scale of real estate investment should be controlled, the development of the real estate industry should be stabilized, the growth rate of non-real estate investment should be accelerated, and the crowding out effect of the real estate industry on non-real estate industries should be avoided as much as possible, and should be reasonable and moderate to maintain the growth of investment in real estate development, and promote the steady and healthy coordinated development of the real estate industry. 2) Innovate regulatory measures and adapt to local conditions. Shiyan, Enshi and Shennongjia forest areas have more natural scenery. In order to avoid damage to the natural environment as much as possible, investment in real estate should be reduced, focus on the development of tourism to promote economic growth, do a good job in the construction of transportation facilities, pay attention to the construction of landscaping, environmental protection, technical services and other engineering facilities, so as to increase the amount of investment in infrastructure and technological transfor-

mation. This can vigorously develop tourism to promote economic growth and protect the natural environment to a certain extent.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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