Chapter 42
An Empirical Analysis of the Relationship Between Real Estate Investment and Economic Growth in Shenyang

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Abstract This paper based on the platform of Eviews 6.0, in the view of the relationship between real estate investment and economic growth in Shenyang using the methods of the cointegration theory, Granger causality test, and error correction model to study empirically the relationship between them. The empirically study result show that, in the long term, there exist the causal relationship, that is the real estate investment growth of Shenyang has significant effect on GDP growth, which can play a good role innuendo and prediction.

Keywords Shenyang real estate investment • GDP • Granger causality test • Error analysis model

42.1 Preface

Shenyang is located in northeast Asian economic circle and it is the center of the Bohai economic circle. As the center of the northeast of China, it has strong absorption radiation and driving force to the surrounding cities, even the whole country and the real estate industry as a important component of the modern industrial system, its development role in boosting to economic growth has attracted the attention of people. Then how the real estate industry create positive function to the economic growth of Shenyang, in which the industrial is as the main pillar industry. Thus became the key content of this paper.

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Table 42.1 The logarithm list of Shenyang's GDP and REI

Particular year	lnGDP	lnREI	Particular year	lnGDP	lnREI
1998	16.0205	12.7837	2004	16.6907	15.0469
1999	16.0893	13.1568	2005	16.8524	15.2351
2000	16.1829	13.3698	2006	17.0422	15.4987
2001	16.2785	13.5683	2007	17.2685	15.8038
2002	16.4002	13.9646	2008	17.4480	16.1289
2003	16.5248	14.3883			

Data sources: "the Shenyang statistics yearbook" [6]

42.2 Data Selection

The paper choose the pull role, which is the total amount of investment of real estate played for the economic growth, as the inspection object, while select GDP, which is the measure of the total amount of goods and services, as a representative economic growth index, and select the real estate investment amount as main reference index of the real estate investment, with REI said. The time series of GDP and REI span for 1998–2008 [1–4]. The original data come from the past "Shenyang statistics yearbook". In order to prevent the time series data to create different variance, and consider the time sequence will not change the nature of the sequence and the relationship after the logarithm, and the data easily become stationary series through that, so before the further processing of the data, the paper approach to take natural logarithms to GDP and REI of Shenyang, the sequence remembered respectively as LNGDP and LNREI (see Table 42.1) [5]. All of the data analysis results are gotten in econometrics software E views 6.0 environment [7].

42.3 Empirical Analysis

42.3.1 The Test of Augmented Dickey-Fulley (ADF Test)

In order to avoid time series produced "false return" phenomenon, it is necessary for us to make the Stationarity Test, and the test method is the stability of unit root test. This paper used the ADF test type. Results list in the following Table 42.2:

The inspection results indicate that through second-order difference, the sequence of LNGDP and LNREI in 5 % of the significant level, show its test statistics corresponding magnitude than critical value. Thus refused to original hypothesis that sequence is not even, which has shown that sequence has unit root, so LNGDP and LNREI are stationary series, both for second order single whole, notes for LNGDP ~ I (42.2), LNREI ~ I (42.2). This paper involves two variables, and variables have the same single whole order number, so can go on the co-integration test for the next step.

Table 42.2 ADF test

Variable	ADF Statistics	DW	Probability	Critical value	Conclusion
lnDGP	0.871977	1.840303	0.8697	−2.00629	Unstable
lnREI	1.904743	2.137372	0.9721	−2.02119	Unstable
dlnGDP	−4.19547	1.732872	0.0536	−4.24650	Unstable
dlnREI	−0.35743	2.137784	0.5232	−4.2465	Unstable
d2lnGDP	−2.64069	1.708080	0.0155	−1.99586	Stable
d2lnREI	−2.3291	1.942776	0.0286	−2.00629	Stable

42.3.2 Co-Integration Analysis of the Variable Sequence

To choose Shenyang's GDP as the dependent variable, REI as the independent variable, using Engle-Granger two-step method for co-integration inspection, so as to analyze the long-run equilibrium relationship. First of all, create Monadic Linear Regression Model by using the OLS method, and then test its residual, to observe whether the sequence is smooth, if it is smooth, then can say they are co-integration, otherwise are not.

The first step:

Firstly, Under the premise of avoiding the model appeared circumstance that is against the hypothesis, approach the sequences of LnGDP and LnREI with reasonable regression analysis, and the structure of the regression equation is as follows:

$$\mathrm{LnGDP} = -0.02 + 0.061 \times \mathrm{lnREI} + 0.956 \times \mathrm{lnGDP}(-1) \tag{42.1}$$

Among:

$$R^2 = 0.998906479669203 \quad \mathrm{DW} = 2.335961527359879$$

The second step:

Unit root test for the regression equation residuals. Make E as the residual sequence of the regression equation, then

$$\mathrm{E} = \mathrm{lnGDP} + 0.02 - 0.061 \times \mathrm{lnREI} - 0.956 \times \mathrm{lnGDP}(-1) \tag{42.2}$$

Test results as shown in Table 42.3:

Because of the unbalanced error t statistic that get from the EG two footwork changed, it's too left compared with the ADF statistics. So for the said inspection results, it should make reference to the critical list EG inspection instead of direct comparing, as the following Table 42.4:

From compare the results and EG critical value table, t statistic value for 3.7521915, less than the 5 % significant level of critical value −3.59, show that at least 95 % confidence level in next reject the null hypothesis, and residual does not

Table 42.3 The unit root test of residual

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	−3.752191547489873	0.001960
Test critical values:		
1 % level	−2.847250364341893	
5 % level	−1.988197973323214	
10 % level	−1.600140081707661	

* Short for probability, is actually a test statistic more or less than the probability of sample observation value. If the P- value significance level is less than the given, that the original hypothesis is unlikely to be set up; if the P- value is greater than the given standard, is that there is no sufficient evidence to reject the null hypothesis

Table 42.4 EG inspection critical value table

		Test level α		
Number of variables N	Sample size T	0.01	0.05	0.10
2	25	−4.37	−3.59	−3.22
	50	−4.32	−3.67	−3.28
	100	−4.07	−3.37	−3.03
	200	−4.00	−3.37	−3.02

exist unit root, it is a stationary series. All in all, through the co-integration test, Shenyang's GDP and REI the two time series is a long-term equilibrium relationship.

42.3.3 Build Error Correction Model

The paper based on the error correction model (ECM), ECM is a short-term model, it can reflect the dependent variable short-term volatility is how to be decided. Build error correction model, the general method is adl model, Model form as follows:

$$Y_t = \beta_0 + \beta_1 X_t + \beta_2 X_{t-1} + \mu Y_{t-1} + \varepsilon_t \tag{42.3}$$

$$\begin{aligned} \Delta Y_t &= \beta_0 + \beta_1 \Delta X_t + (\beta_1 + \beta_2) X_{t-1} - (1-\mu) Y_{t-1} + \varepsilon_t \\ &= \beta_1 \Delta X_t - (1-\mu)\left[Y_{t-1} - \tfrac{\beta_0}{1-\mu} - \tfrac{\beta_1+\beta_2}{1-\mu} X_{t-1}\right] + \varepsilon_t \\ \Delta Y_t &= \beta_1 \Delta X_t - \lambda(Y_{t-1} - \alpha_0 - \alpha_1 X_{t-1}) + \varepsilon_t \end{aligned} \tag{42.4}$$

Formula (42.3) explain how the short-term volatility of dependent variable y is to be decided. On the one hand, it is influenced by the short-term volatility of independent variable accidents x, on the other hand, depends on the ECM. ECM reflects the variables deviation degree of equilibrium relationship in the short-term volatility, called equilibrium error. Due to the co-integration relationship between the GDP and its real estate investment, to investigate the short-term fluctuations variables, we choose a steady residual sequence as error correction projects to develop ECM models, the error correction model:

Table 42.5 Grange table r causality test

Null Hypothesis:	Obs	F-statistic	Prob.
LNREI does not Granger Cause LNGDP	8	4633.61	0.0108
LNGDP does not Granger Cause LNREI		6.36921	0.2816

$$\begin{aligned} \mathrm{D(lnGDPt)} = 0.00540 + 0.04431\mathrm{D(ln\,REIt)} + 0.97199\mathrm{D(ln\,GDPt-1)} \\ - 1.49196\mathrm{ECMt-1} \end{aligned} \tag{42.5}$$

$$R^2 = 0.893834 \quad DW = 2.285283$$

Among:

$$\mathrm{ECM_{t-1}} = \ln \mathrm{GDP_{t-1}} + 0.02 - 0.061 \ln \mathrm{REI_{t-1}} - 0.956 \ln \mathrm{GDP_{t-2}} \tag{42.6}$$

Type (42.5) type (42.6) show that, in the short term the independent variable real estate investment each 1 % growth, will cause the dependent variable Shenyang's GDP growth of 0.04431 %. Error correction of the coefficient of 1.49196 for-that when LNGDP in the previous deviating from the long-term equilibrium value, LNREI will make in the next in the opposite direction of correction, with −1.492 times the unbalanced state adjustments back to balance state.

42.3.4 Granger Causality Test

The above research and analysis show that the two time series, Shenyang's GDP and REI, are long-term equilibrium. Then if there is a relationship of causality, and the real estate investment is help to predict the regional economic growth, are not clear. And Granger causality test is not logical causality test, but see variables of mutual order, whether there is a variable in the early period of the information will affect another variable current information. So next we do the Granger Causality Test, the result as shown in Table 42.5 shows:

The said inspection showed that the original hypothesis "LNREI does not Granger Cause LNGDP" accept probability for 0.0108, show that 5 % of significant levels to reject the null hypothesis, explains namely of Shenyang city investment in real estate development is the Granger reason of it's GDP, and the original hypothesis "LNGDP does not Granger Cause LNREI" probability for 0.2816, show that 5 % of the level of significance under the original hypothesis that explain the Shenyang's GDP is not the Granger reason of its investment in real estate development.

42.4 Conclusion

According to the above research, there exist Granger Causality between Shenyang's investment in real estate development and its economic growth. Further analysis, Shenyang's GDP growth is not the main factors in pulling the real estate investment growth, and Shenyang's real estate investment make significant influence to GDP growth, that means every 1 % increase in REI, will pull the local GDP growth of 0.061 %. Can only say that real estate investment in a certain extent promote the growth of GDP. From 2002 to 2004, Shenyang's real estate investment development present situation of high growth, of which 2004 investment growth to 93.2 %, from 2005 under the state's macro-regulation it present in the buffer stage, Although the real estate investment is volatile industry in contrast, but from this paper analysis, Shenyang's real estate investment can play very good prediction effect for regional economy.

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