Chapter 40
Study on the Correlation Between Urbanization and Economic Development, Real Estate Market in Xi'an

Donglang Yang, Tianzhe Li and Yiqi Li

Abstract This paper is based on the urbanization, economic development and real estate market data in Xi'an city using the analysis model of Econometrics includes entropy, stability testing, Johansen Cointegration and Granger causality test to explore the interactions and relationships among economic development, urbanization and the real estate market. The results show that: the level of economic development, urbanization and the development of the real estate market since 2001 in Xi'an have steadily improved overall; there is a long-term equilibrium relationship among the economic development, urbanization and the real estate market; In the 5 % level of significance, for each Granger causality between economic development and urbanization; Urbanization is the Granger cause of the real estate market development, but lack empirical support for the inverse relationship; Economic development is not the Granger cause of the real estate market development, but also the development of the real estate market is not the Granger cause of the economic development. Based on the results of this study, this paper presents the corresponding policy suggestions.

Keywords Urbanization · Economic development · Real estate market · Granger test

40.1 Introduction

Since 2001, Xi'an city's economy has been growing at a more rapid pace of development, and the level of urbanization is also rising. At the same time, the real estate market closely linked to the urbanization and economic development is also booming. At present, the research literature on economic development, urbanization, the real

D. Yang (✉) · T. Li · Y. Li
Institute of Real Estate Research, Xi'an Jiaotong University, Xi'an 710049, China
e-mail: yangdl@mail.xjtu.edu.cn

T. Li
e-mail: 502923609@qq.com

Y. Li
e-mail: 75539455@qq.com

L. Shen et al. (eds.), *Proceedings of the 19th International Symposium on Advancement of Construction Management and Real Estate*,
DOI 10.1007/978-3-662-46994-1_40

estate market is more, but the relation between the three has fewer discussions. Therefore, this article discussed the interactions among the economic development, urbanization and the real estate market of Xi'an, committed to a clear understanding of the mechanism among the three, in order to develop urban development guidelines and policies on science, and to promote the healthy and sustainable development of society.

40.2 Index System and Methods

40.2.1 Indicators Constructed

This article was based on 2001–2012 data authority in "Xi'an Economic and Social Development Statistical Yearbook", the comprehensive formulation factor indicators build Xi'an's urbanization, economic development, real estate market relations quantitative indicator system (Table 40.1).

Table 40.1 Build relationships Indicators among economic development, urbanization, and the real estate market in Xi'an

Target	Interpretation layer	Classification layer	Index layer
Research on the relationship between urbanization, economic development and real estate market	Urbanization	Demographic indicators	Population urbanization rate
			The proportion of non-farm payrolls of the population
			The urban proportion of the population
		Industry Indicators	Secondary industry GDP
			Gross production of tertiary industry
	Economic development	Economies of scale	GDP
			Total fixed asset investment
			Revenue
		Economic level	Per capita household disposable income
			Total wages of employees
	Real estate market	Development index	Investment in real estate development
			Housing area
		Output indicators	The average price of commercial housing
			Real estate sales

1. The level of urbanization. Urbanization is mainly reflected in the development and expansion of urban population by the progress of the social process of rural to urban concentration, including the increase in urban population and rural population relative reduction, the increase in the number of towns and the expansion of urban scale, economic relationship between the town and the popularity of the mode of production and expand and so on (Yu 2005). Thus, the level of urbanization in this study uses population index and industrial index to represent. Specific indicators include population urbanization rate, the proportion of non-farm payrolls, the urban proportion of the population, secondary industry GDP, the total value of the tertiary industry production.
2. The level of economic development. According to the connotation and influencing factors of economic development, follow the indicators selected scientific, systematic, comparability and accessibility principles, drawing on existing achievements, construction of evaluation index system of the level of economic development from two aspects economics scale and economic level. Specific indicators including GDP, fixed asset investment, financial income, per capita household disposable income, total wages of employees (Zhu et al. 2009).
3. Level of the real estate market. According to the connotation and influencing factors of real estate market development, follow the indicators selected scientific, systematic, comparability and accessibility principles, drawing on existing achievements, construction of the real estate market development level evaluation system from the real estate development indicators and output indicators. Specific indicators include investment in real estate development, housing area, the average price of real estate, real estate sales.

40.2.2 Research Methods

This paper uses the entropy method, ADF test, co-integration analysis, analysis method of Grainger causality test econometric, through analysis and Research on the dynamic relationship among the urbanization, economic development and the development of the real estate market in Xi'an. Of which: ① using ADF test inspection urbanization, economic development, real estate market timing stability of three series; ② in three sequences having the same order single whole premise to establish vector autoregression (VAR) model, using Johansen test method to verify the existence of cointegration relationship among the variables that examine the long-term equilibrium relationship; ③ Granger causality test carried out on the basis of co-integration equation, contacts and visits between the three intrinsic role.

40.3 Data Processing

In information theory, entropy:

$$H(x) = -\sum_{i=1}^{n} p(x_i) \ln p(x_i)$$

Information entropy is used to measure the uncertainty of the system, or is used to measure the degree of disorder of the system. Information is a measure of degree of order system.

Object hypothesis in comprehensive evaluation system set M = (M1, M2, …, Mm), evaluation index system for the D = (D1, D2, …, Dn), evaluation object Mi on the index of Dj value is denoted as X = (Xij) m × n, X then the decision matrix:

$$X = \begin{bmatrix} & D_1 & D_2 & \cdots & D_n \\ M_1 & x_{11} & x_{12} & \cdots & x_{1n} \\ M_2 & x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ M_m & x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix}$$

Through every index quantification of same, using P_{ij} to calculate the P_{ij} proportion in the j index index scheme for I

$$p_{ij} = \frac{X_{ij}}{\sum_{i=1}^{n} X_{ij}}, \quad (i = 1, 2 \ldots, n, j = 1, 2 \ldots, m)$$

The index is calculated on the J its entropy value e_j, which is calculated as:

$$e_j = -k \sum\nolimits_{i=1}^{n} p_{ij} \ln(p_{ij})$$

Among them $k > 0$, $k = 1/\ln(n)$, $e_j \geq 0$.

The calculation formula of entropy, for a target Dj, difference X_{ij} smaller, E_J is bigger; if all of the above X_{ij} are equal, so when e_j = emax = 1, in comparison of scheme, index X_j will not have the slightest effect; so when the index value the greater difference between each program, the amount of information will be reflected by the larger, while E_J will be smaller. To determine the entropy weight of every index is:

$$W_j = \frac{1 + \frac{1}{\ln m} \sum_{i=1}^{m} p_{ij} \ln(p_{ij})}{\sum_{k=1}^{n} 1 + \frac{1}{\ln m} \sum_{i=1}^{m} p_{ij} \ln(p_{ij})}$$

The entropy weight by calculating substitution the different index can be calculated score index of each layer of concrete:

$$s_i = \sum_{j=1}^{m} w_j \cdot p_{ij} \quad (i = 1, 2, \ldots, n)$$

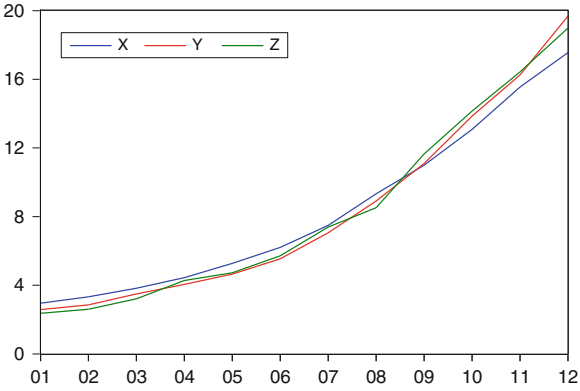

Fig. 40.1 Urbanization, economic development, the real estate market development level index in Xi'an

Calculated based on the entropy method to determine the weight of, the source data of Xi'an's economic development, urbanization, the real estate market-related data into a comprehensive evaluation, then get the 2001–2012 level of urbanization index, the level of economic development index and the level of development of the real estate market index in Xi'an, which was a chart showing (Fig. 40.1):

Urbanization, economic development, the real estate market development level index.

40.4 Data Test

40.4.1 Stationary Test

In order to ensure the unbiasedness, effectiveness and best guarantee of the regression results, before the cointegration analysis of the level of urbanization, economic development and the development of the real estate market, must be stationary test to the test, namely the presence of unit roots.

If a time series X_t is stable, then:

1. the mean E (X_t) and independent of the time t;
2. Variance Var (X_t) is limited, is not generated with the passage of time t changes in the system.

Then, the time series X_t will tend to return to its average, in a relatively constant amplitude fluctuations around the mean.

If a time series X_t is non-stable, then the mean and variance will change with t. For example, the sequence of random walks

$$x_t = x_{t-1} + \varepsilon_t;\ \varepsilon_t \sim (0, \delta^2)$$

If $X_0 = 0$ then

$$x_t = \sum_{i=1}^{t} \varepsilon_i Var(x_t) = t\delta^2$$

when $t \to \infty$, $Var(x_t) \to \infty$, the mean is without meaning, X_t sequence has actually reached the return point of a desired time is infinite.

A stable sequence can generally use an autoregressive moving average expression ARMA (P, q) said:

$$x_t = \varphi_1 x_{t-1} + \cdots + \varphi_p x_{t-p} + \xi_t + \theta\xi_{t-1} + \cdots + \theta_q \xi_{t-q}$$

Using ADF test time series urbanization level (x), the level of economic development (y) and the development of the real estate market level (z) stability. The test results are given in Table 40.2.

Because each variable test results show there are unit root, which are non-stationary series, Therefore, the unit root test must be carried out on its first difference. Based on the variable first-order differential trends can be preliminary judgement, can be seen from Fig. 40.2, the level of urbanization (x), the level of economic development (y) and the development of the real estate market level (z) of the first-order differential dx, dy, dz still has the upward trend.

From the test results, the ADF test value of the original sequence 6.748457, 9.580192, 4.038408 respectively greater than the corresponding critical values, and thus can not reject the null hypothesis (the existence of a unit root), showed that x, y, Z are non-stationary series; on three sequences of first-order difference, respectively, to the Δx, Δy, Δz, then use the ADF test, ADF test value −0.997090, 0.682309, −1.468331 were greater than the corresponding critical values, show that the three sequence of first-order differential are non-stationary series. On three sequences of two order difference, ΔΔx, ΔΔy, ΔΔz were obtained respectively, and then were analyzed by ADF test, ADF test value −4.097047, −4.155463, 4.918437 were less than 5 % significance level critical value, show that the two order three sequence difference are stationary series.

40.4.2 Johansen Cointegration Test

Cointegration means that if the sequence X_{1t}, X_{2t}, …, X_{kt} are d-order single whole, there is a vector:

Table 40.2 Results of unit root test

Sequence	Variable name	ADF test value	1 % level	5 % level	10 % level	Probability	Conclusion
The original sequence	x	6.748457	−4.200056	−3.175352	−2.728985	0.9999	Non stationary
	y	9.580192	−4.200056	−3.175352	−2.728985	0.9999	Non stationary
	z	4.038408	−4.200056	−3.175352	−2.728985	1.0000	Non stationary
The first order difference sequence	Δx	−0.997090	−4.297073	−3.212696	−2.747676	0.7095	Non stationary
	Δy	0.682309	−4.420595	−3.259808	−2.771129	0.9825	Non stationary
	Δz	−1.468331	−4.297073	−3.212696	−2.747676	0.5072	Non stationary
Two order differential sequence	ΔΔx	−4.097047	−4.582648	−3.320969	−2.801384	0.0183	stable
	ΔΔy	−4.155463	−4.420595	−3.259808	−2.771129	0.0143	stable
	ΔΔz	−4.918437	−4.420595	−3.259808	−2.771129	0.0052	stable

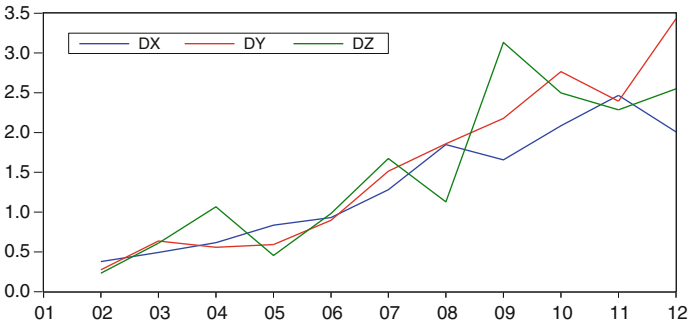

Fig. 40.2 First-order differential trend graph

$$\alpha = (\alpha_1, \alpha_2, \ldots, \alpha_k)$$

Make:

$$Z_t = \alpha X_t^{'} \sim I(a - b)$$

Among them, b > 0, Xt = (X_{1t}, X_{2t}, …, X_{kt}) That sequence X_{1t}, X_{2t}, …, X_{kt} is (d, b) Order cointegration, denoted as

$$X_t \sim CI(d, b)$$

α is a cointegration vector.

If two variables are single integer variable, and only when their single whole order is the same, it may co-integration, a single whole order if they are not the same, it is impossible cointegration. In the stationary test results can be learned, the level of urbanization, economic development level and the level of development of the real estate market is second-order single whole, and conduct Johansen cointegration premise for the series are integrated of the same order, so x, y, z three sequences cointegration test conditions are met.

In this study, use the method of Johansen cointegration test to test cointegration of the three variables. First constructed vector autoregression model (VAR), select "sequence has the certainty of a linear trend, cointegration equation only intercept" has been co-integration test results (Table 40.3).

Test results table is based on the largest eigenvalues (Maximum Eigenvalue) that Max-Eigen statistic test results table, It is a test of the null hypothesis that there are r cointegration contrary, there are r + 1 cointegration relationships.

Johansen cointegration test results shows that when the critical value of trace test statistics regression equation is greater than the 5 % confidence level, reject its assumptions; otherwise accept his assumptions. The relationship between these four variables cointegration test results show that, at the 5 % level, the existence of a long-run equilibrium relationship between variables, which implies the existence of

Table 40.3 Johansen cointegration test results (1), results (2)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical value	Probability
Result 1				
None*	0.999165	111.0980	29.79707	0.0000
At most 1	0.974442	40.22160	15.49471	0.0000
At most 2	0.299080	3.553608	3.841466	0.0594
Result 2				
None*	0.999165	70.87638	21.13162	0.0000
At most 1	0.974442	36.66799	14.26460	0.0000
At most 2	0.299080	3.553608	3.841466	0.0594

interactions between the long-term development of urbanization, economic development and real estate market.

40.4.3 Granger Causality Test

Cointegration analysis can reveal whether there is a long-term equilibrium relationship between variables, but the equilibrium relationship is a causal relationship, you need to verify through the Granger causality test (Sun 2009). Granger believes that the variable cointegration relationship exists between these variables case, there exists at least one direction of Granger causality. Therefore, to further explore the causal relationship between the various time series (Zhou and Li 2004).

Under the 5 % significance level, "Y (Economic Development) is not X (urbanization) rejected Grainger reason", and "X (urbanization) is not Y (Economic Development) Grainger reason" can not be refused show that for each Granger causality between economic development and urbanization. Under the 5 % significance level, "Z (real estate market) is not X (urbanization) Granger cause" was rejected, and "X (urbanization) is not Z (real estate market) Granger cause" can not be rejected, indicating that urbanization is the Granger cause of the development of the real estate market, but lack of empirical support for the inverse relationship; at

Table 40.4 The Granger causality test results

Lag	Null hypothesis	F-statistic	Probability	Result
1	Y does not Granger Cause X	10.7504	0.0155	reject
	X does not Granger Cause Y	8.50514	0.0246	reject
2	Z does not Granger Cause X	5.18661	0.0603	accept
	X does not Granger Cause Z	10.3136	0.0168	reject
3	Z does not Granger Cause Y	0.17641	0.8433	accept
	Y does not Granger Cause Z	2.70129	0.1602	accept

the 5 % significance level, "Z (real estate market) is not Y (economic development) Granger cause", and "Y (economic development) is not Z (real estate market) Granger cause" not to be rejected, indicating that economic development is not the Granger cause of the real estate market development, while the real estate market is not the Granger cause of economic development.

Thus, the development of urbanization and economic reinforce each other in Xi'an, that economic development to some extent, contributed to the process of urbanization in Xi'an, while urbanization also makes more rapid economic development and improvement; orderly urbanization is an important factor in promoting the booming real estate market, while economic development is not the main factor in promoting the development of the real estate market, but that does not mean that economic development will not have an impact on the real estate market, but the impact is relatively weak; the real estate market development is not the reasons of economic development and urbanization. This means that in the analysis of the relations between the three, the development of this market is only the result and not as a cause to promote the economic development and urbanization (Table 40.4).

The results show that: the economic development has attracted Xi'an surrounding agricultural population and non-urban population into the cities, to promote the city's industrial structure optimization and value increase, making the process of urbanization in Xi'an significantly accelerated, at the same time, the promotion of the urbanization process promote the optimization of industrial structure, increase the supply of labor force, directly or indirectly to meet a variety of conditions in the city in the process of economic development required. In addition, urbanization leads to the change of the land use structure and the way so as to improve the efficiency of the allocation and utilization benefit, which directly promote the development of the real estate market (Wu 2006); However, the real estate market does not promote economic development, improve the level of urbanization, because of the level of economic development, improving the process of urbanization is largely dependent on various elements of the input increases, the relationship between the different elements are cumbersome and complex, One aspect of the real estate market as one of the impact, the promotion of relations between the two can not be fully reflected.

40.5 Conclusions and Recommendations

40.5.1 The Main Conclusions

By entropy method, cointegration test and Granger causality test, perform a quantitative analysis to the urbanization, economic development and the development of the real estate market, draw the following conclusions:

First, by entropy method to calculate the level of urbanization and level of economic development, the level of development of the real estate market in Xi'an each year, you can find a comprehensive evaluation of the three scores were rising

over time, and the three score's rises are very close, up speed faster. This shows that since the beginning of the 21st century with the process of urbanization in Xi'an urban development continues to accelerate economic development is accelerating, the real estate market is also expanding.

Second, urbanization and economic development, the development of the real estate market cointegration relationship exists between various indexes. It is said that in the short term, urbanization and economic development, the development of the real estate market may fluctuate relationship, but in the long run, there is a long-term stable equilibrium relationship between urbanization, economic development and the development of the real estate market.

Third, by Granger test, found in the 5 % significance level, mutual Granger causality between economic development and urbanization. The town is the Granger cause of the real estate market development, but the real estate market is not the Granger cause of urbanization. Economic development is not the Granger cause of real estate market development, while the real estate market is not the Granger cause of economic development. This suggests that the development of the real estate industry, urbanization and economic development is still in uncoordinated stage.

Fourth, the economic development by increasing the total GDP, increase revenue, increase income, create a favorable macroeconomic environment for urbanization; by providing a large number of employment opportunities, solve the problem of new urban population, create a favorable economic environment for the urbanization of onlookers. Urbanization provides the necessary space for the city's economic development through financial contributions and taxes for the government as well as to attract capital and labor, in order to accumulate funds for construction of urbanization. Economic development and urbanization both reinforce each other, complementary and mutually promote the development of each other. Urbanization makes the demand for urban housing supply increases, making the real estate industry to integrate more funds for construction, thus urbanization is the Granger cause of the real estate market.

The conclusion can help us better understanding the relations between urbanization, economic development, and the real estate market development. About urbanization and economic development, the real estate market, existing research mainly uses regression analysis, correlation analysis to reveal the relationship between the three, did not solve the problem of the interaction and mutual influence mechanism between the variables. In this study, economic analysis of measurement explore the dynamic relationship between urbanization and economic development, the development of the real estate market, analyzes the trend between the urbanization and economic development, the development of the real estate market and the interaction between the urbanization and economic development, the development of the real estate market.

40.5.2 Policy Recommendations

First, Xi'an should be explored new urbanization patterns in the current pattern of urbanization, set the urbanization development planning through scientific, a reasonable measure of the size of a standard all types of land, reasonably determine the land policy, careful planning town, district and so on, to keep real estate industry reasonable pace, in order to effectively control the real estate market, and promote the stable development of the real estate market.

Second, the scale and speed of real estate development should be coordinated with the process of urbanization, adapt to the economic development level of Xi'an city and affordability, government in the real estate market regulator housing total also should construct multi residential supply channels. Building a new population of housing security system covering the urbanization of the city.

Third, Xi'an should be further transformation of economic development mode, optimizing the layout of industrial upgrading, increased capital investment and technological innovation, continue to strengthen business investment, economic development more dependent on technological advances rather than the allocation of resources, reducing the economic development's dependence on the land resources. By properly regulate the mode of economic development, in order to optimize the allocation of resources in the urbanization and promote healthy development of urbanization. In the process of transformation of the economic development and the urbanization, let them combined with each other and promote each other, not at the expense of agriculture and food, ecology and the environment at the expense of economic development and to balance urban and rural development, urban and rural integration, the city in interactive, intensive, ecological and livable, harmonious development of the new town is the core of the defense transformation.

References

Sun J (2009) Intermediate econometrics. Shanghai University of Finance and Economics Press, Shanghai, pp 272–331

Wu S (2006) Study the interaction between urbanization and real estate development. Huazhong Agricultural University, Wuhan

Yu F (2005) Urbanization and intensive use of land resources research. Res Dev 2:80–82

Zhou J, Li Z (2004) Granger causality test the applicability. J Tsinghua Univ (Nat Sci) 3:358–361

Zhu T, Yang G, Weizhong Su (2009) Yangtze River Delta urban land use evaluation and coordination of economic and social development. Resour Sci 7:1109–1116