

Study on the Coupling Coordination Degree Between Real Estate Industry and Regional Economy in Liaoning Province

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Abstract—Real estate is an important industrial sector in the national economy and can make outstanding contributions to regional economic development. Taking Liaoning Province as an example to conduct quantitative research on the coordination between its economic development and the real estate industry, and uses the coupling model to study the changes of coupling coordination scheduling from 2010 to 2019. On this basis, on this basis, the coordination degree between the two of the 14 prefecture-level cities in Liaoning Province is obtained. The study found that the coordination between the two was inverted U-shaped, and the decline was obvious after 2015. From the perspective of cities, only Shenyang and Dalian, the top two cities in GDP, are highly coordinated. And the rest are on the verge of imbalance or lower. Therefore, it is suggested that in economically underdeveloped cities, we should accelerate the increase of the total population and stimulate real estate consumption. At the same time, through the development of the tertiary industry, we can improve the economic aggregate and achieve coordinated development between them.

Keywords-component; Liaoning Province; Real estate industry; Regional economy; Coordination degree

1 INTRODUCTION

In regional economic theory, industry is the main body of the economy, the level of industry often determines the quality of a country's economy, and the rapid development of economy can also drive the transformation and upgrading of industry^[1]. Therefore, since the 1980s, the role of real estate industry in the national economy has become more and more prominent, and has made important contributions to regional economic development and local fiscal revenue^[2]. The steady improvement of the national economy has led to the rapid growth of residents' disposable income, stimulated people's demand for better real estate, and promoted the development of the entire real estate industry^[3]. It can be seen that the coordinated development of real estate industry and regional economy is particularly important. At present, many scholars have carried out research on the interaction between the property industry and the economic environment^[4]. Li Qixuan (2019) qualitatively analyzed the impact of real estate development on Zhengzhou's economy, and bring forth a proposal on how to promote their coordinated development^[5]. Li Wenfeng et al. (2020) took the real estate industry in Fujian Province as an example to study the relationship between them, and found that with the continuous expansion of their scale, the coordination level is also improving^[6].

Wang Xiaofang (2018) took Guangxi Province as the research object and used the grey correlation method to conduct empirical research on their coordination degree. It was found that except a few big cities such as Nanning and Liuzhou, other cities did not reach a benign coordination state ^[7].

In conclusion, Relevant research results, existing research has made relatively rich achievements in this field. Most of the existing studies take the southern provinces of China as the research object, and there are few studies on Liaoning and other Northeast provinces, and many studies have some subjective factors in determining the index weight ^[8]. Therefore, taking Liaoning as the research object can make up for the lack of research in northern provinces of China, Based on the statistical yearbook data, the empirical research is carried out to reveal the dynamic coupling process between real estate industry and regional economy in Liaoning Province. And put forward feasible countermeasures on how to realize their coordinated development

2 MODEL BUILDING AND DATA SOURCES

Through literature review, it is found that many experts in this field have built indicator systems and used many indicators. On the basis of referring to the previous research results, combined with the research purpose of this paper, this paper constructs the evaluation index system of the coordination degree of real estate industry and regional economy ^[9], as shown in Table 1.

Table 1 Index System

Primary index	Secondary index
Real estate system	Real estate investment
	Building construction area
	Completed building area
	Building completion value
Regional economic system	gross domestic product
	Per capita GDP
	Fixed assets investment
	Local fiscal revenue

In the constructed index system, the primary index is divided into real estate system and regional economic system. The real estate system includes four secondary indicators: real estate investment, housing construction area, housing construction completion area and housing construction completion value. The regional economic system includes four secondary indicators: total output value, per capita GDP, fixed asset investment and local fiscal revenue. In order to show the dynamic change of its coordination degree, the actual data from 2010 to 2019 are collected according to the indicator system, all of which are from the statistical yearbook of Liaoning Province.

3 ESTABLISHMENT OF COUPLING COORDINATION DEGREE MODEL BETWEEN REAL ESTATE INDUSTRY AND REGIONAL ECONOMY

3.1 Determine weight

In the research of index system evaluation, determining the index weight is a crucial link. Common analysis methods include expert scoring, factor analysis, etc. However, these methods have obvious defects in determining the weight of indicators, that is, too much human participation makes the results difficult to be accepted by more people. In order to solve this problem, introduces the entropy method in physics, which can obtain the index weight more objectively. The entropy method determines the impact of the index on the whole according to its degree of dispersion. The higher the calculated dispersion value, the greater the weight of the index, and vice versa.

$$e_j = -\frac{1}{\ln m} \sum_{i=1}^m y_{ij} \ln y_{ij} \quad (i=1..n; j=1..m) \quad (1)$$

$$d_j = 1 - e_j \quad (2)$$

Where e_j is the entropy value of the j -th index, m is the number of research objects, y_{ij} is the probability of occurrence of i , and d_j is the redundancy. After calculating the above data, we can determine the weight of each indicator.

$$w_j = \frac{d_j}{\sum_{j=1}^m d_j} \quad (3)$$

After that, combined with the actual data of each indicator, the comprehensive score of the development level of the economy and real estate in Liaoning Province was obtained.

$$f_i = \sum_{j=1}^m w_j \cdot p_{ij} \quad (4)$$

Where f_j is the multiple score, and p_{ij} is the index value of the index.

3.2 Measurement model of coupling coordination degree

After obtaining the development level scores of the two systems, the coordinated development level is calculated on this basis. This formula is widely used in similar problems in the field of physics, so it can be introduced into economic research.

$$C = 2 \sqrt{\frac{F_1 \times F_2}{(F_1 + F_2)^2}} \quad (5)$$

C is the coupling degree; F_1 and F_2 are the comprehensive development level of real estate subsystem and regional economic subsystem respectively; Coupling degree $C \in [0,1]$. The closer the C value is to 0, the more uncoupled the two systems are, while the closer the C value is to 1, the more fully coupled the two systems are. Most of the time, the value of C is between these two cases.

$$T = \alpha F_1 + \beta F_2 \quad (6)$$

$$D = \sqrt{CT} \quad (7)$$

D is the coupling and co scheduling of real estate industry and regional economy; C is the coupling degree; T is the degree of development. T is obtained by F_1 and F_2 weighted correction, α and β is the weight coefficient; The coupling coordination degree $D \in [0,1]$. When D approaches 0, it indicates that the system development is maladjusted, and when D approaches 1, it indicates that the coupling coordination degree of system development is high. Since the development degree of real estate industry and regional economy is the result of the joint action of many factors, they interact, promote and influence each other so let's make α and β equal to 0.5. Meanwhile, with reference to the existing research results, the judgment criteria of coupling coordination degree are determined, as shown in Table 2.

Table 2 Coordination level table

Interval of D value	Coordination level	Coupling coordination degree
(0.0-0.1)	1	Extreme disorder
(0.1-0.2)	2	Serious disorder
(0.2-0.3)	3	Mild disorder
(0.3-0.4)	4	Moderate disorder
(0.4-0.5)	5	Verge of disorder
(0.5-0.6)	6	Reluctantly coordinate
(0.6-0.7)	7	Primary coordination
(0.7-0.8)	8	Intermediate coordination
(0.8-0.9)	9	Good coordination
(0.9-1.0)	10	Quality coordination

4 EMPIRICAL ANALYSIS

4.1 Entropy weight

Before empirical research, in order to avoid the impact of extreme values on the analysis results, the data needs to be preprocessed. There are many ways to solve the problem of data standardization. The max-min method is used here. Due to space constraints, the detailed calculation process is not shown here. Then, the entropy weight method introduced above is used to calculate the weight of each index of the two subsystems. Table 3 lists the weights of each index in the two systems. In the real estate industry, the weight of the building completion

value is the largest, with a value of 0.5668, and the weight of the building completion area is the smallest, with a value of 0.1082. In the regional economic system, the weight of fixed assets investment is the highest, with a value of 0.4391, and the weight of GDP is the lowest, with a value of 0.1339.

Table 3 Index weight

Real estate system	weight	Regional economic system	weight
Real estate investment	0.1871	Gross domestic product	0.1339
Building construction area	0.1082	Per capita GDP	0.1342
Completed building area	0.1379	Fixed assets investment	0.4391
Building completion value	0.5668	Local fiscal revenue	0.2929

4.2 Comprehensive score of each system

Then, the two systems are evaluated with reference to the weight values and standardized data of each index system of real estate economic system and regional economic system, and the comprehensive scores of each system are obtained, as shown in Figure 1.

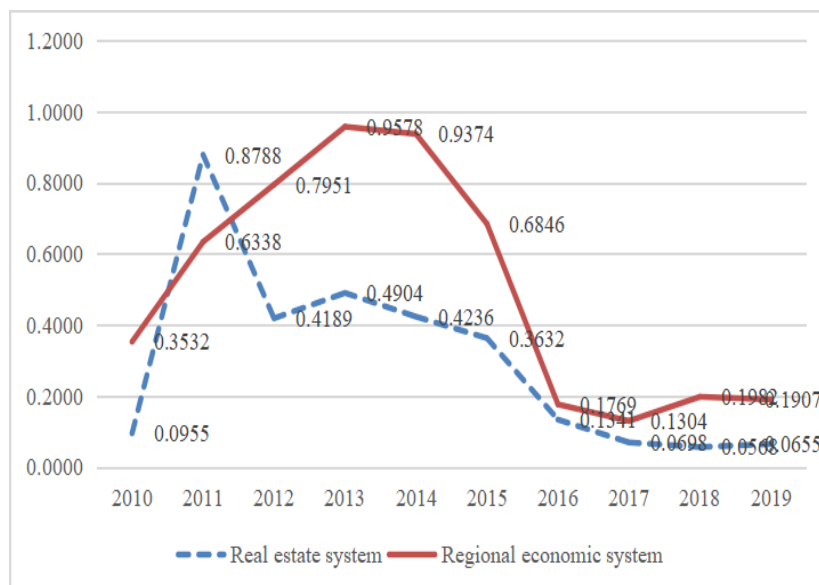


Figure 1. Change of coupling coordination degree in Liaoning Province

It can be clearly seen from the figure that from 2010 to 2019, the comprehensive score of real estate system and economic system in Liaoning Province showed an inverted U-shaped change and development trend. After the real estate system reached its peak in 2011, it showed a

downward trend year by year. Population is the core driving force for the sustainable development of the real estate industry, but in recent years, the population growth rate of Liaoning Province has slowed down, especially the negative population growth in many small and medium-sized cities in Liaoning Province, which has led to a significant decline in the demand for real estate. At the same time, the weak economic growth of Liaoning Province is also one of the important reasons, and the economic system also shows the same change trend. After reaching the peak in 2013, it shows a downward trend year by year. In recent years, the GDP ranking of Liaoning Province in China's provincial administrative regions continues to decline, from the seventh in 2013 to the 15th in 2019. The slowdown of economic development has further restricted the development of the real estate industry.

4.3 Coupling coordination degree

Using the model introduced in the previous article, the coupling and coordination level of Liaoning Province is empirically analyzed. The results are shown in Table 4

Table 4 Coupling coordination in Liaoning Province

Year	C-value	T-value	D-value	Coordination level	Coupling coordination degree
2010	0.8188	0.4737	0.6227	7	Primary coordination
2011	0.9868	0.8697	0.9264	10	Quality coordination
2012	0.9508	0.7791	0.8607	9	Good coordination
2013	0.9465	0.8509	0.8974	9	Good coordination
2014	0.9260	0.8249	0.8740	9	Good coordination
2015	0.9518	0.7238	0.8300	9	Good coordination
2016	0.9905	0.3943	0.6249	7	Primary coordination
2017	0.9531	0.3164	0.5491	6	Reluctantly coordinate
2018	0.8323	0.3571	0.5452	6	Reluctantly coordinate
2019	0.8723	0.3579	0.5587	6	Reluctantly coordinate

It can be seen from the table 4 that from 2010 to 2019, the coordination and coupling level of real estate industry and regional economy in Liaoning Province fluctuated greatly. Before 2015, it was basically in a good state of coordination. In particular, high-quality coordination was achieved in 2011. However, after 2016, the level of coordination and coupling showed a downward trend, and from 2017 to 2019, it was only reluctantly coordinated. This change trend is consistent with the level of real estate industry and regional economy in Liaoning Province. It can be seen that in recent years, the development of real estate industry and regional economy in Liaoning Province has encountered great difficulties, development stagnation, and even negative growth. The combination of these factors leads to the coordination and coupling level between real estate industry and regional economy in Liaoning Province from high-quality coordination to Reluctantly coordination.

4.4 Coupling coordination among cities

In order to study this problem more comprehensively and systematically, using the 2019 statistical data, we will further take 14 prefecture-level cities in the province as the research object to analyze the coupling coordination degree of each city. The research results are shown in Table 5.

Table 5 Coupling coordination OF 14 cities

City	D-value	Coordination level	City	D-value	Coordination level
Shenyang	0.9872	10	Yingkou	0.4167	5
Dalian	0.7662	8	Fuxin	0.0970	1
Anshan	0.4107	5	Liaoyang	0.1977	2
Fushun	0.1566	2	Janjin	0.2525	3
Benxi	0.1680	2	Tieling	0.1021	2
Dandong	0.2552	3	Chaoyang	0.2546	3
jinzhou	0.2615	3	Huludao	0.2593	3

It can be seen from table 5 that among the 14 cities, only Shenyang and Dalian have a high degree of coupling and coordination, and the rest are on the verge of imbalance or lower.

5 CONCLUSIONS AND RECOMMENDATIONS

This paper constructs a coordinated coupling index evaluation system between real estate industry and regional economy, and studies Liaoning Province and its 14 cities. It is found that the coordinated coupling in Liaoning Province has changed in an inverted U-shape in recent years. The coordination degree of most cities in the province is at a low level and needs to be improved.

Therefore, in order to further improve the coordination and coupling level of real estate industry and regional economy in Liaoning Province, it should be optimized from the following aspects. In the areas where the real estate industry is underdeveloped in the province, a series of policies have been issued to encourage and attract foreign residents to settle down, actively expand the population scale, and introduce domestic well-known real estate development enterprises to create high-quality residential projects to improve the effective demand of the real estate industry. In areas with backward regional economic development, we should focus on promoting industrial transformation and upgrading, accelerating the development of strategic emerging industries, finding new growth points for the regional economy, improving the economic aggregate, and driving the continuous upgrading of Liaoning's economic ranking. Finally, through high-quality development, promote the coupling and coordinated development of the two.

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REFERENCES

- [1] Fang, F. , L. Jin, and Y. Zhang. "Research of the Coupling Coordination Degree Between Tourism Industry and Regional Economy Based on the Gear Model——Taking Yangtze River Delta Megalopolis as an Example." *Journal of Nanjing Normal University (Natural Science Edition)* .2013.
- [2] Tang, X. , and Y. Guo . "Study on the Relationship between Urban Real Estate Industry and Regional Economy-Based on Shaanxi Province and the under Jurisdiction of 10 Cities." *ence & Technology for Development* .2018.
- [3] Huang, T. , Y. Hao , and S. A. University . "Analysis of Coupling and Coordination Between Civil Aviation Industry and Regional Economy in Northeast China." *China Transportation Review* .2019.
- [4] Li Qixuan. Coordinated development of real estate industry and regional economy -- a case study of Zhengzhou. *China Market*, vol.36 pp.46-50.2019
- [5] Li Wenfeng, Sun Tianzi. Evaluation of Coupling Coordination Degree between Fujian Real Estate and Regional Economy. *Jiangxi Building Materials*, vol.05, pp233-235.2021
- [6] Wang Xiaofang. Research on the coordination between Guangxi real estate and regional economic system based on Grey Theory. *Journal of Guilin University of Aerospace Technology*, vol., 23(03): pp.347-353.2018
- [7] Chen, J. C. , and Z. N. Chen . "Coupling Coordination Degree between Real Estate Industry and Regional Economy in China." *Commercial Research* .2011
- [8] Jiang, Y. , et al. "Regional Tourism Industry and Economic Coupling Coordination Degree-A Case Study of Eastern Ten Provinces(Municipalities)." *East China Economic Management* .2012.
- [9] Liao, M. L. . "Research on Coupling Coordination Degree between Human Resources and Regional Economic Development in Guangxi Beibu Gulf Based on Entropy Evaluation Method." *Journal of Guangxi Normal University (Philosophy and Social Sciences Edition)*.2016