Study on the Cooperative Development of Real Estate Industry and Regional Economy in Underdeveloped Areas
——Take Heyuan as an example

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ABSTRACT
The real estate industry is one of the pillar industries in China, but there are few studies on the synergy between the real estate industry and regional economy in underdeveloped areas. Taking Heyuan City as the research object, this paper constructs a collaborative model of real estate industry and regional economy, analyzes the collaborative maturity of Heyuan City's real estate industry and regional economy, and finds that the order degree of real estate industry subsystem and regional economy subsystem is constantly improving, and the gap between them is narrowing. At the same time, the collaborative maturity of the real estate industry and regional economy increases slowly in the fluctuation, but the overall collaborative level is low, which needs to be further improved.

Keywords: Real estate, Regional economies, Order degree, Collaborative maturity

1. INTRODUCTION

At present, the real estate industry is still one of the pillar industries in China. At the same time, housing is also an important part of family assets. Under this background, domestic scholars have done a lot of research on the relationship between real estate and regional economy. Yin Ningyu, Zhao Xiang and Wang Jun (2017) analyzed the industrial spatial distribution of Guangdong Province from the correlation coefficient between labor productivity and housing price [1]. Tang Xiaoling and Guo Yue (2018) analyzed the relationship between the real estate industry and regional economy in Shanxi Province, and found that there was a high coupling degree between the two, and gradually improved [2]. Li Qixuan (2019) took Zhengzhou as an example to analyze the impact of real estate development on regional economy [3]. Li Youjian (2020) analyzed the impact of real estate investment on regional sustainable development, and put forward the path of sustainable development and coordinated development of real estate investment and regional economy [4].

However, the current research on the real estate industry pays less attention to the relationship between the real estate industry and regional economy in underdeveloped areas. Therefore, this paper takes Heyuan City, a underdeveloped area in northern Guangdong as the research object, constructs a model of real estate industry and regional economic cooperation, analyzes the collaborative maturity of the real estate industry and regional economy in Heyuan City, and puts forward corresponding development suggestions. At present, the research on real estate industry pays less attention to the relationship between real estate industry and regional economy in underdeveloped areas. Therefore, this paper takes Heyuan City, an underdeveloped area in northern Guangdong Province, as the research object, and constructs a collaborative model of real estate industry and regional economy. Then through empirical analysis of Heyuan real estate industry and regional economy collaborative maturity, and put forward the corresponding development suggestions.

2. CONSTRUCTION OF COLLABORATIVE MODEL BETWEEN REAL ESTATE INDUSTRY AND REGIONAL ECONOMY IN HEYUAN CITY

2.1. Composite system construction

The composite system composed of real estate industry and regional economy in Heyuan City is defined as f (F1, F2), where F1 and F2 represent the real estate industry subsystem and regional economy subsystem of Heyuan City respectively, and the index composition of the two subsystems is shown in Table 1.

2.2. Dimensionless processing of index value

Because of the different dimensions and orders of magnitude, each index should be processed to eliminate the effect of different dimensions on the evaluation results. In this paper, the initial value method is used for dimensionless processing.

2.3. Determine the index weight

In order to distinguish the importance of indicators, it is necessary to give corresponding weights to the indicators. Here, only the real estate system indicators are introduced as an example, and the regional economic system indicators are calculated in the same way. In this paper, entropy method is used to give weight, and the weight of index I is:

$$ w_i = \frac{1-e_j}{\sum_{i=1}^{m}(1-e_j)}, \, j=1,2....n \quad (1) $$

2.4. Measurement model of subsystem order degree

$f_1(x_{ij})$ is defined as the order of the system order parameter component x_{ij}, and its calculation formula is as follows:

$$ f_1(x_{ij}) = \begin{cases} \dfrac{x_{ij}^{'} - \min\limits_{i} x_{ij}^{'}}{\max\limits_{i} x_{ij}^{'} - \min\limits_{i} x_{ij}^{'}} & \text{Positive vector index} \\ \dfrac{\max\limits_{i} x_{ij}^{'} - x_{ij}^{'}}{\max\limits_{i} x_{ij}^{'} - \min\limits_{i} x_{ij}^{'}} & \text{Negative vector index} \end{cases} $$

$$ (i=1,2,...,m, \, j=1,2,...,n) \quad (2) $$

The order degree of real estate subsystem is p_1^{j}, which can be determined by linear weighted summation method. The order degree of regional economic subsystem can be calculated by the same method.

$$ p_1^{j} = \sum_{i=1}^{m} w_i f_1(x_{ij}), w_i \geq 0, \sum_{i=1}^{m} w_i = 1 $$

$$ (i=1,2,...,m, \, j=1,2,...,n) \quad (3) $$

Among them, w_i and w_t are the weight of the index.

2.5. System collaborative maturity measurement model

"For a certain initial time j_0, the order degree of the subsystem is p_1^{0}, and for a certain subsequent time j_1, the order degree of the subsystem is p_1^{1}. if $p_1^{1} \geq p_1^{0}$ and $p_2^{1} \geq p_2^{0}$ are established at the same time, it can be considered that the two subsystems have achieved coordinated development" [5]. The collaborative maturity is as follows:

$$ d = sig \sqrt{\left| p_1^{1} - p_1^{0} \right| \left| p_2^{1} - p_2^{0} \right|} \quad , $$

$$ p_1^{1} \geq p_1^{0} \text{ and } p_2^{1} \geq p_2^{0}, sig=1, \text{ otherwise } sig=-1 \quad (4) $$

3. EMPIRICAL RESEARCH

3.1. Index selection

To analyze the coordination maturity of real estate and regional economy in Heyuan City, we need to analyze the order degree of real estate and regional economy first. In order to make the evaluation system more realistic, which can not only reflect the law of regional economic and social development, but also reflect the operation state of the real estate industry subsystem and regional economic subsystem, this paper constructs three-level indicators to calculate the order parameters of the real estate industry subsystem from two aspects of scale and efficiency. That is to say, from three aspects of total amount, structure and living standard, three-level indicators are constructed to calculate the order parameters of regional economic subsystem, as shown in Table 1.

3.2. Data sources

The data of this paper comes from the statistical yearbook of Heyuan City from 2006 to 2020.

3.3. Collaborative maturity of the collaborative development system of real estate industry and regional economy in Heyuan City

After dimensionless processing, the real estate and regional economic data of Heyuan City are brought into the formula (1)(2)(3)(4) in turn, and finally the relevant data of collaborative maturity between real estate and regional economy of Heyuan City are obtained, as shown in Table 2.

3.3.1 the order degree and collaborative maturity of each subsystem are on the rise

As an underdeveloped city in northern Guangdong, Heyuan City has been increasing efforts to undertake industrial transfer. In recent years, Heyuan City has focused on the development of electronic information industry, advanced equipment manufacturing, new material manufacturing, life and health industries, actively integrated into the Shenzhen-Dongguan-Huizhou economic circle, and achieved rapid development of regional economy. According to the relevant statistics, the annual growth rate of GDP in Heyuan City is higher than 10%, and the order of regional economic subsystem is increasing year by year.

In recent years, with the well-known real estate enterprises sinking to the third and fourth tier cities and the improvement of economic living standards, the real estate industry in Heyuan has achieved rapid development, which has also stimulated the development of regional economy. Figure 1 shows that the collaborative maturity of real estate industry and regional economy in Heyuan fluctuates, but the overall collaborative maturity is still gradually increasing.

Table 1. evaluation index system and weight of collaborative maturity of real estate industry and regional economy in Heyuan City

Subsystem	Order parameter		weight
Real estate subsystem	Scale index	Total investment in real estate development (X1)	0.179282
		Completed housing area this year (X2)	0.084855
		Actual sales of commercial housing(X3)	0.230854
		Construction Engineering (X4)	0.094527
		Installation project (X5)	0.084664
		Land purchase cost (X6)	0.238056
		Ratio of real estate development investment to tertiary industry (X7)	0.042791
	Efficiency index	Contribution rate of real estate development to fixed assets investment of the whole society(X8)	0.044971
Regional economic subsystem	Total index	GDP (Y1)	0.172059
		Fixed assets investment of the whole society (Y2)	0.338001
		Year end social employees (Y3)	0.00242
	Structural indicators	Proportion of tertiary industry in GDP(Y4)	0.023155
		Proportion of urban population(Y5)	0.024611
	living standard	Regional per capita GDP (Y6)	0.147507
		Per capita housing area of urban residents (Y7n)	0.018828
		Per capita disposable income of urban residents (Y8)	0.109286
		Total retail sales of social consumer goods per capita (Y9)	0.164133

Table 2. collaborative maturity of the collaborative development system of real estate industry and regional economy in Heyuan City

year	Order degree of real estate subsystem(F1)	Order degree of regional economic subsystem(F2)	Collaborative maturity(d)
2005	0.000215	0.007633	⎯⎯
2006	0.039268	0.063338	0.046641
2007	0.069673	0.134527	0.046524
2008	0.04364	0.161829	-0.02666
2009	0.055401	0.186943	0.017187
2010	0.062397	0.230627	0.017482
2011	0.214003	0.278463	0.08516
2012	0.220043	0.347666	0.020444
2013	0.29273	0.416586	0.070779
2014	0.29322	0.518352	0.007065
2015	0.371136	0.600391	0.079951
2016	0.555262	0.69285	0.130476
2017	0.741807	0.817819	0.152684
2018	0.784777	0.883804	0.053249
2019	0.936	0.999652	0.132359

3.3.2 the order degree of real estate subsystem is gradually approaching that of regional economy subsystem

Figure 1 shows that the order degree of real estate subsystem in Heyuan City has decreased three times. This may be due to the influence of international economic environment and real estate policy, which leads to the synchronous decrease of real estate development and sales in Heyuan City, and then leads to the decline of the order degree of real estate subsystem

in Heyuan City. At the same time, the order degree of the regional economic subsystem of Heyuan City has been higher than that of the real estate subsystem, but the gap between the two has gradually narrowed after 2015, and the overall development trend of the two is synchronous. This is because after 2015, with the gradual implementation of the monetized resettlement policy of the national shantytowns transformation, more and more well-known real estate enterprises began to enter the market of Heyuan City, which promoted the rapid development of the real estate industry in Heyuan City and gradually improved the order degree of the real estate subsystem.
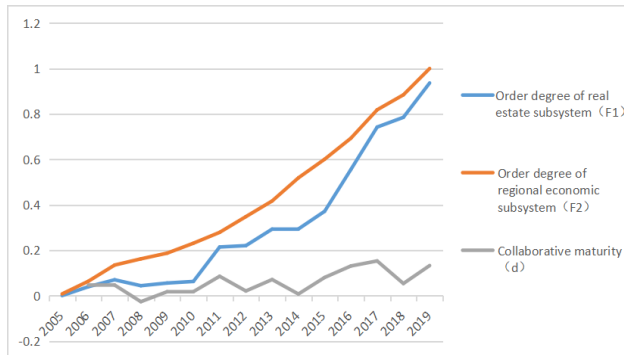

Figure 1 order degree and coordinated development maturity degree of real estate industry and regional economic subsystem in Heyuan City

3.3.3 the cooperative maturity fluctuation of the two subsystems is slowly increased

Figure 1 shows that since 2005, the collaborative maturity of real estate industry and regional economy in Heyuan City has decreased significantly in 2008, 2014 and 2018 respectively, and there is an obvious gap in the curve. The collaborative maturity of the two subsystems is -0.02666 in 2008, which indicates that the global economic and financial crisis in 2008 has had a great impact on the real estate industry, resulting in the

negative growth of real estate development investment and real estate sales in that year, so the collaborative maturity of the two subsystems is negative. The collaborative maturity of the two subsystems decreased significantly in 2014 and 2018. This is due to the high inventory of China's real estate industry in 2014 and the real estate downturn. In 2018, the government proposed the policy of "real estate, housing and non speculation" and issued intensive real estate regulation policies, which limited the development of the real estate industry. On the whole, the real estate industry in

Heyuan City has gradually improved in recent years, and the trend of collaborative maturity of real estate industry and regional economy is greatly affected by the development of real estate industry.

3.3.4 the real estate industry of Heyuan City has a driving effect on the regional economy as a whole

Since 2005, except for 2008, the collaborative maturity of Heyuan real estate industry and regional economy is positive, which indicates that Heyuan real estate industry has played a positive role in promoting the development of regional economy as a whole.

3.3.5 the overall coordination between real estate industry and regional economy needs to be further improved

In order to better serve the local economy, the real estate industry and regional economy need to develop in coordination, promote each other and improve together. Since 2005, from the perspective of development trend, the collaborative maturity of the real estate industry and regional economy in Heyuan City is not stable enough, and has declined significantly for many times; from the perspective of absolute value, the collaborative maturity of the real estate industry and regional economy in Heyuan City is relatively small, which indicates that although the two have achieved collaborative development as a whole, the collaborative level is still low and needs to be further improved.

4. CONCLUSION

In order to give full play to the role of the real estate industry in promoting regional economic development, Heyuan City needs to take appropriate measures to promote the healthy and coordinated development of the real estate industry in Heyuan City, and continuously improve the collaborative maturity level of real estate and regional economy. Firstly, further improve the land transfer system, implement centralized land release, increase the difficulty and financial pressure for real estate enterprises to acquire land at the same time, promote real estate enterprises to acquire land rationally, and help the healthy and stable development of the real estate industry. Secondly, scientifically plan urban development, coordinate regional economic development and urban development planning with a forward-looking vision, and consider various factors such as regional economy, population development, city scale, natural resources, etc. to avoid resource waste and financial risks caused by excessive investment in real estate. Thirdly, vigorously promote the transformation of old urban districts, gradually transform old urban districts, optimize urban environment and improve residents' living standards based on the specific situation

of Heyuan City. Fourthly, make full use of the advantages of regional natural resources, vigorously develop leisure and old-age real estate, attract Greater Bay Area residents to Heyuan for leisure and old-age investment, and then drive regional economic development.

ACKNOWLEDGMENTS

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