Benefit Evaluation of Real Estate Industry Based on SBM Model

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ARTICLE INFO	ABSTRACT
	According to the situation of real estate industry in different provinces and cities, the benefit is different, and the benefit of real estate industry in some regions is low. Based on the statistical data of real estate industry in various regions, this paper selects nine indicators, such as the number of enterprises, the average number of employees, the land purchase area (10000 square meters) in this year, to evaluate and analyze the benefit of real estate industry in 31 regions of China by using two-stage super efficiency model. The results show that the input-output of the real estate industry in 17 regions is effective, and the remaining 14 regions are DEA ineffective. The reasons for the inefficiency of the input-output are analyzed, and some suggestions to improve the efficiency are given.

1. Introduction

In recent years, with the rapid development of China's economy, housing has become the rigid demand of a family, the scale of real estate development is expanding, and the price is increasing. Market supply exceeds demand, and at the same time, there is a great deal of speculation, which makes housing prices seriously deviate from value, resulting in an economic phenomenon of real estate bubble [1]. The development efficiency of the real estate industry in each city will be affected by local policies and economic factors. At the same time, the real estate industry has an impact on the use of land resources and national economy. This paper mainly evaluates the benefit of the cross-sectional data of real estate in 31 regions of China in 2019. Before that, Meng Chuanjin (2008) selected 500 real estate enterprises in China as the decision-making unit, and pointed out that enterprises should pay more

attention to business efficiency [2]. But there is no specific suggestion to improve the business efficiency. Zeng Zhaofa (2013) used the stochastic frontier production function model to conduct an empirical study on the efficiency level of real estate development in China's provinces. It is concluded that there are great differences in the development benefits of various provinces and cities in China, but the ranking and specific benefits of different provinces and cities are not given [3]. Yang yingzhe (2017) research shows that: the overall transformation efficiency of China's real estate enterprises is low, and there is a large room for improvement in both the preparation stage and the implementation stage [4]. But did not point out the specific problems of each province. Yuan Qingmin (2020) used DEA model to give the efficiency values of the three urban agglomerations in different stages, but did not distinguish the super efficiency areas from other areas [5]. In summary, there are a large number of literature on the evaluation

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of real estate benefits in China, but most of them are the analysis suggestions given from the perspective of some regions or from the perspective of the market. There is no research based on the benefits of the real estate industry in different regions, and there is no specific benefit value of the real estate industry in different regions. Based on the above problems, from the perspective of the real estate industry, this paper selects 31 regions as decision-making units, uses SBM model to solve the benefit value of different regions, and gives suggestions for the regions with invalid input.

2. Data Sources and Processing

2.1 Data Sources

The data come from the China Statistical Yearbook 2020. Referring to Zhang Qi and Liu Rong, nine indicators are selected as the research objects, which are: number of enterprises, average number of employees, land purchase area (10000 square meters), completed investment this year, newly started housing area this year, completion rate of housing construction area (%), completed value of housing, sales area of commercial housing and main business income. 31 regions in China are selected as decision-making units.

2.2 Selection of Indicators

The real estate investment is mainly considered from two aspects: labor input and capital input. The labor input is the number of enterprises and the average number of employees; Selection of capital investment: land purchase area of this year (10000 square meters), completed investment of this year, a total of four investment indicators [8]. Output indicators from the perspective of labor output, the main outputs are: the new construction area of housing this year, the completion rate of housing construction area (%), and the indicators of capital output are the sales area of commercial housing, the completion value of housing, and the main business income. These five indicators. Nine indicators and 31 regions were studied as decision-making units.

3. The Solution of the Model

3.1 Model Introduction

Based on the existing research results, this paper studies the efficiency ranking and efficiency value of 31 regions in China by using the non oriented SBM model with constant scale benefit. Data envelopment analysis (DEA) is a nonparametric method of technical benefit analysis, among which the most basic models are BCC and CCR.

SBM model is evolved from these two models. In the radial DEA model, the measurement of inefficiency only includes the proportion of equal proportion reduction (increase) of all inputs (outputs). For the invalid DMU, the gap between its current state and the strong effective target value includes not only the equal proportion improvement, but also the relaxation improvement. The improved part of relaxation is not reflected in the measurement of efficiency. Tone Kaoru (2001) proposed SBM model [5]. The advantage of SBM model is to solve the problem that the radial model does not include relaxation variables in the measurement of inefficiency. This paper studies the efficiency of China's real estate industry based on the non oriented SBM model with constant scale efficiency.

$$\text{Objective function: } \rho_{SE} = \frac{\dfrac{1}{m}\sum_{i=1}^{m} \overline{x_i}\big/x_{ik}}{\dfrac{1}{q}\sum_{r=1}^{q} \overline{y_r}\big/y_{rk}}\Bigg|$$

$$s.t.\begin{cases} \overline{x_i} \geq \sum_{j=1,j\neq k}^{n} x_{ij}\lambda_j \\ \overline{y_r} \leq \sum_{j=1,j\neq k}^{n} y_{rj}\lambda_j \\ \overline{x_i} \geq x_{ik} \\ \overline{y_r} \leq y_{rk} \\ \sum_{j=1,j\neq k}^{n} \lambda_j = 1 \\ \lambda, s^-, s^+, \overline{y} \geq 0 \\ i=1,2,\ldots,m; r=1,2,\ldots,q; j=1,2,\ldots,n(j\neq k) \end{cases}$$

(1)

SBM model is a non oriented super efficiency model with constant scale benefit, m input index x_i and q output indexes y_i; x_{ij} is the j-th input of the i-th DMU, y_{rj} is the j-th output of the r-th DMU, s^-, s^+ are relaxation variables, and λ is weight coefficient. The θ obtained by this model is the efficiency value of the j decision unit. In the sBM $\theta < 1$ model of super efficiency, $\theta = 1$ is invalid, $\theta > 1$ is weak and effective, which is the super efficiency.

3.2 Result Analysis

Using the SBM model of constant reward and non oriented super efficiency, and with the help of dea-solver software, the efficiency values of real estate industry in 31 regions of China in 2019 are shown in Table 1 and Table 2

respectively.

It can be seen from Table 1 that the 17 regions of Xinjiang, Ningxia, Hehai, Shanghai, Chongqing, Tibet, Jiangsu, Jiangxi, Sichuan, Beijing, Henan, Gansu, Shanxi, Inner Mongolia, Tianjin, Shandong and Heilongjiang are DEA efficient, and the first 16 of them are DEA super efficient, with the efficiency value greater than 1. It shows that there is no waste of resources in the development of real estate industry in these 17 areas, and the real estate industry in these areas has high efficiency. In these areas, there are developed Beijing and Shanghai, where the real estate industry is mature, the market is more standardized, and the urban population density is high; Tibet, Xinjiang and Inner Mongolia have developed rapidly in real estate industry with high efficiency due to the economic development and policy reasons in frontier areas in recent years.

NPC and CPPCC, the highest in one belt, one road in Xinjiang, the highest efficiency in 2.166, 2019 years. After the end of the two sessions, Xinjiang's real estate industry is very important. The "one belt and one road" led to the economic development of Xinjiang. Urumqi's international land port and airport two port construction, Xinjiang's cultural and creative industry exhibition and so on have far-reaching impact on Xinjiang's real estate industry.

It can be seen from Table 2 that Hubei, Guangdong, Jilin, Hunan, Zhejiang, Shaanxi, Anhui, Qinghai, Liaoning, Guizhou, Hebei, Yunnan, Fujian, Guangxi and these 14 regions are DEA invalid. The results show that the benefits of the real estate industry in these areas still need to be improved. The development of real estate should be combined with the local demand and policy, instead of blindly building houses, which is not conducive to the use of environmental resources and the development of local economy. For the 14 invalid DEA decision-making units, the target values of the invalid DEA decision-making units are given, which can be used as a reference for the improvement of the real estate industry in the 14 regions. See Table 3 for details:

In order to study the impact of different indicators, Hubei, Guangdong, Guizhou, Qinghai and Guangxi were selected as representatives to study the result data and analyze the reasons.

The number of enterprises in Hubei decreased by 161, the average number of employees, the land purchase area of this year (10000 square meters) and the completed investment of this year remained unchanged, while the new construction area, the completion rate of the construction area (%) and the completed value of the houses increased. For Hubei only, some real estate enterprises are ineffective and have not brought the greatest economic benefits.

And these inefficient enterprises will occupy the land area, but due to the low efficiency, the new construction area and the completion rate of housing construction area this year will be reduced, which will eventually lead to the low completion value of housing.

Among the input variables in Guangdong, only the completed investment this year decreased by 565.88, and the other three input indicators did not change. However, the newly started housing area, the completion rate of housing construction area (%) and the finished value of housing in this year all increased. For Guangdong, part of the investment has not played a real role. The real economy of Guangdong Province is in recession, but the real estate industry is relatively prosperous, which leads to the hollowing out of Guangdong economy. The excess investment does not lead to the increase of new construction area and completion rate, the completion value does not improve, the pure technical efficiency is not high, and the new construction area and completion rate need to be improved.

Among the input variables in Guizhou, only the average number of employees decreased by 25447, and the remaining three input indicators did not change, while the completion rate (%) of housing construction area, housing completion value and main business income all increased. For Guizhou Province, the problem is that there are too many practitioners in the real estate industry, but some of them are inefficient, which may be caused by professional technology and other reasons, resulting in the low completion rate of housing construction area. The part of the cost needed to be invested is invalid. When the utilization of these invalid resources is reduced, the operating revenue will also increase.

Among the input variables in Qinghai region, only the land purchase area decreased by 61.29 in this year, the other three input indicators did not change, while the completion rate of housing construction area (%), the completion value of housing, the sales area of commercial housing, and the main business income all increased. For Qinghai, the land purchase area is too large in 2019, which leads to the failure of enterprises in the region to complete the production of purchase area, thus reducing the completion rate of housing construction area, greatly improving the completion value of housing, and increasing the sales area and main business income of housing.

Guangxi has the lowest efficiency among the 31 regions, which is more complicated than Hubei, Guangdong, Guizhou and Qinghai. Among the input variables, only the number of enterprises does not need to be changed, the average number of employees needs to be reduced by 1283, the land purchase area this year needs to be reduced

Table 1. DEA effective area score table

region	Xinjiang	Ningxia	River and sea	Shanghai	Chongqing	Tibet
score	2.166	1.343	1.258	1.257	1.148	1.133
region	Jiangsu Province	Jiangxi	Sichuan	Beijing	Henan Province	Gansu Province
score	1.114	1.108	1.096	1.054	1.052	1.051
region	Shanxi	Inner Mongolia	Tianjin	Shandong	Heilongjiang	
score	1.037	1.03	1.02	1.007	1	

Table 2. DEA invalid area score table

region	Hubei	Guangdong	Jilin	Hunan	Zhejiang	Shaanxi	Anhui
score	0.585	0.571	0.556	0.529	0.527	0.486	0.47
region	Qinghai	Liaoning	Guizhou	Hebei	Yunnan	Fujian	Guangxi
score	0.436	0.429	0.384	0.349	0.334	0.327	0.315

Table 3. Target value of invalid decision unit

DMU	Number of enterprises	Average number of employees	Land purchase area of this year	Investment completed this year	New construction area of housing in this year	Completion rate of building area(%)	House completion value	Sales area of commercial housing	Main business income
Hubei	4114	136313	784.9	5111.73	9792.75	27.71	1628.10	8602.04	4837.02
Guangdong	9239	271392	1240.33	15286.28	18557.78	50.77	5776.61	13846.54	16160.51
Jilin	1231	32916	464.02	1104.40	2947.01	34.18	546.43	2122.34	986.81
Hunan	4366	131415	1261.56	4445.47	11933.23	47.86	1154.03	9103.5	3900.54
Zhejiang	6824	130969	1683	8679.00	12730.92	54.72	3312.55	9378.31	9247.5
Shaanxi	2640	86269	485.11	3903.65	6431.21	27.05	1332.71	4401.06	3402.53
Anhui	4112	126022	1294.55	5499.34	11117.46	57.54	2073.517	9229.38	5124.85
Qinghai	304	9280	104.43	406.29	865.9	5.36	172.03	604.70	314.06
Liaoning	1973	52950	651.31	2339.36	4363.65	37.05	1062.75	3696.27	2492.57
Guizhou	2763	85338	534.26	2990.81	7239.89	19.58	741.03	5323.31	2219.97
Hebei	3498	98632	1047.34	3814.44	9452.68	78.43	1150.54	5282.7	2726.97
Yunnan	2860	82813	869.23	3196.81	8018.51	59.92	950.77	4835.41	2307.41
Fujian	3519	112575	1031.7	3720.58	7645.02	73.14	1865	6456.13	3377.07
Guangxi	3056	93613	1053.93	3105.29	8218.52	63.44	1274.60	6711.77	2602.00

Table 4. Improvement value of five cities

region	index	Number of enterprises	Average number of employees	Land purchase area of this year	Investment completed this year	New construction area of housing in this year	Completion rate of building area(%)	House completion value	Sales area of commercial housing	Main business income
Hubei	actual value	4275	136313	784.90	5111.73	8708.85	7.60	961.61	8602.04	4837.02
	target value	4114	136313	784.90	5111.73	9792.75	27.71	1628.10	8602.04	4837.02
	Improved value	-161	0	0	0.00	1083.90	20.11	666.49	0	0
Guangdong	actual value	9239	271392	1240.33	15852.16	18437.38	11.50	4569.93	13846.54	16160.51
	target value	9239	271392	1240.33	15286.28	18557.78	50.77	5776.61	13846.54	16160.51
	Improved value	0	0	0	-565.88	120.40	39.27	1206.68	0	0
Guizhou	actual value	2763	110785	534.26	2990.81	7239.89	3.40	230.25	5323.31	1718.81
	target value	2763	85338	534.26	2990.81	7239.89	19.58	741.03	5323.31	2219.96
	Improved value	0	-25447	0	0	0	16.18	510.78	0	501.15
Qinghai	actual value	304	9280	165.72	406.29	865.90	4.60	31.66	480.52	202.01
	target value	304	9280	104.43	406.29	865.90	5.36	172.03	604.70	314.06
	Improved value	0	0	-61.29	0	0	0.76	140.37	124.18	112.05
Guangxi	actual value	3056	94896	1186.93	3814.41	8218.52	6.80	582.45	6711.77	2342.83
	target value	3056	93613	1053.93	3105.29	8218.52	63.44	1274.60	6711.77	2602.00
	Improved value	0	-1283	-133.00	-709.12	0	56.64	692.15	0	259.17

by 33, and the completed investment this year needs to be reduced by 709.12. The completion rate of housing construction area (%), the completion value of housing, the sales area of commercial housing, and the main business income all increased. In particular, the completion rate increased by 56.64%. It shows that the real estate enterprises in Guangxi have a large development space, and the development is relatively mature. The number of employees, the area of purchase and the amount of investment are in excess, so there is a lot of room for development. There is a gap between the real estate development of Guangxi and the developed areas. The unbalanced development of the real estate industry in Guangxi, the low proportion of the employed population in the real estate industry, the small average registered capital of the real estate development enterprises in Guangxi, and the small proportion of their own funds in the total assets lead to the backwardness of the real estate industry in Guangxi.

4. Summary and Suggestions

First, one belt, one road, and another one, uneven development. From the data, we can see that the real estate industry is influenced by many factors, such as Xinjiang, and is affected by the "one belt and one way". The resources of real estate industry in developed areas are more efficient. Guangdong, as a coastal city, has the largest amount of investment, but Tibet and Ningxia, as remote areas, have relatively less resources. Therefore, for remote areas, more talents should be introduced, so as to drive the development of local real estate industry and other industries, and promote the good development of regional economy.

Second, the allocation of resources is unreasonable. From the comparison of the target value and time value of DEA data, the problems existing in many regions are the unreasonable allocation of resources. There are four input indicators: the number of enterprises, the average number of employees, the land purchase area of this year (10000 square meters), the completed investment of this year, and the situation of surplus. It shows that the resources in many regions are surplus, or the resources are not fully utilized. As a result, the final output index still has room for development. Regions should make full use of resources, do not "speculation", adjust measures to local conditions, targeted to the regional real estate industry planning, in order to maximize the use of resources and maximize output.

Funding

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