Comprehensive Evaluation on the Health of Real Estate Market in Shandong Province

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Abstract. In this thesis, the evaluation index system of the real estate market (REM) health is established through the cluster analysis method, which includes 11 indicators and 4 levels. Research methods include: Analytic Hierarchy Process (AHP) is used to determine each indicator weight; The linear weighted method is used to obtain the health value; The systematic method is used to get the health standards threshold. In the end, the healthy development of Shandong REM are analyzed from two aspects of temporal evolution and spatial difference. The results are shown as follows: (1)The health of Shandong REM is mainly affected by supply-demand and price level, of which real estate investment(REI) and price are the most significant factors. (2) From temporal evolution, Shandong REM fluctuate weaker and weaker, and tend to be stable and cool. (3) The regional development of REM in 17 cities was imbalanced, and most cities were well-run, in addition to heating in Qingdao, overheating in Rizhao, cooling in Zaozhuang, Jining and Weihai. Finally, the author puts forward some suggestions on the healthy and stable development of Shandong REM.

Introduction
Since the reform of the housing system in 1998, China's real estate industry has been booming and been a key factor driving economic growth for a long time. Due to the short history and complexity of the REM, various problems exist such as rising housing prices, the real estate bubble, land revenue, empty city, “ghost town”, etc., which have seriously affected the sustainable, steady and healthy development. The REM health is related to the national economy and the people's livelihood. In order to regulate the REM properly, one has to estimate its health correctly. However, health standards and judgments on the REM are often disagreement at home and abroad, coupled with its geographical heterogeneity, which makes the study more complicated.

Literature Review
At abroad there are few direct research on the health of the REM, and the research topics mainly focus on the estate bubble and warning.[1-2] The domestic research on it mainly focuses on the theoretical connotation, index system, evaluation methods and standards. On the discussion of connotation, the concept of REM health is more and more standardized and enriched. It has gone through the process from inside to outside of the REM and then to the unification with each other, from a single economic factors to the comprehensive factors including economic, social, ecological environment, etc.[3] On the construction of the index system, the index system of “price-scale-speed-equilibrium”,[3,4] “bubble-efficiency-sustainability”[6] and “economic-social-environmental”[6-7] are mainly formed. Evaluation methods include multi-factor synthetic evaluation,[4] deviation degree method,[3] system dynamics method,[8] etc. Theoretical model,[3,5] experiential method and statistical test[5] are often used to determine health standards. The above research has enriched the REM theory, and made a great contribution to promoting the orderly, stable and healthy development of the REM at home and abroad.

Regionalism is an important characteristic of the REM. Most domestic research is dominated by the whole country or developed cities, and the conclusions are not universal to other areas. And by consulting a large amount of literature, we find that few empirical studies on the health of the REM
in Shandong Province. Therefore, a set of evaluation system on the health of Shandong REM is established, which provide a quantitative analysis tool for the REM regulation.

Research Methods

Construction of Index System

Drawing lessons from previous research, the author holds that the healthy REM should include two meanings: Firstly, the internal operation of the REM is stable and the supply-demand relationship tends to balance; Secondly, the external operation of the REM should maintain harmony with each other in the macro-economy, people's life, and ecological environment. Only by maintaining the coordination of the internal and external operation, can the REM develop healthily. From this perspective, using AHP, the evaluation process is divided into 3 layers, namely the target, principle and scheme layer. The following research path is used to establish the evaluation index system: Determining the objective of evaluation - Selecting the scheme layer indicators - Cluster analysis - Defining the principle layer indicators - Determining the weight. That is to say, instead of defining the principle layer indicators in advance, we first select the scheme layer indicators, and then use the cluster analysis method to classify them. The classification is the principle layer indicators. This approach can effectively avoid the subjectivity in the classification of scheme layer.

Based on the principle of comprehensiveness, representativeness, availability and comparability, 11 indicators of the scheme layer are selected. Then with SPSS 22.0, we cluster the 10 years data of 11 indicators and obtain the dendrogram, from which 4 principle layer indicators are defined. Thus the index system of health evaluation of REM in Shandong Province was established. We use expert scoring method and AHP to determine the weight of each indicator. The results are shown in Table 1.

Table 1. The Health Evaluation Index System of REM in Shandong Province and its Weight.

| Principle layer | Weight ($W_1$) | Scheme layer | Weight ($W_2$) | Combination weight ($W$) |
|-----------------|----------------|--------------|----------------|-------------------------|
| Price level     | 0.5456         | Housing price to income ratio 0.6491 | 0.3542         |
|                 |                | Residential buildings price growth rate/GDP growth rate 0.0719 | 0.0392         |
|                 |                | Residential buildings price growth rate/Per capita disposable income of households growth rate 0.2790 | 0.1522         |
| Structure level | 0.0942         | Floor space of residential buildings completed/Floor space of commercialized buildings completed 0.1429 | 0.0135         |
|                 |                | The sale of residential buildings/Total sale of commercialized buildings 0.4286 | 0.0404         |
|                 |                | Residential buildings investment/Real estate investment 0.4286 | 0.0404         |
| Speed level     | 0.0829         | Residential buildings investment growth rate/REI growth rate 0.6586 | 0.0546         |
|                 |                | Residential buildings investment growth rate/GDP growth rate 0.1562 | 0.0130         |
|                 |                | Residential buildings investment growth rate/Fixed assets investment growth rate 0.1852 | 0.0154         |
| Supply-demand level | 0.2772 | REI growth rate/Urban population growth rate 0.7500 | 0.2079         |
|                 |                | Floor space of residential buildings completed/Urban population growth rate 0.2500 | 0.0693         |

Construction of Evaluation Model

In this paper, we use the linear weighted method to calculate the health value of the REM. The formula is as follows:
\[ U = \sum \Sigma u_k = \sum w \cdot x_{ij}. \quad (1) \]

Among them, \( U \) is the comprehensive health value; \( u_k \) is the \( k \)-th indicator's health value of the principle layer; \( w \) is the \( i \)-th indicator's combination weight of the scheme layer; \( x_{ij} \) is the \( i \)-th indicator's value of the \( j \)-th year or city.

**Determination of Health Standard**

Based on the index system and the calculated REM health value, combined with the actual operation of the REM, we use the systematic method of statistical theory to determine the health standards of Shandong REM in the time series and spatial pattern (see Table 2 and Table 3).

**Table 2. Health Standards of Shandong REM in the Time Series.**

| Health state | Undercooling | Cooling | Health | Heating | Overheating |
|--------------|--------------|---------|--------|---------|-------------|
| Threshold    | [−∞, 2.794]  | (2.794, 3.498] | (3.498, 4.907) | [4.907, 5.611) | [5.611, +∞) |

**Table 3. Health Standards of Shandong REM in the Spatial Pattern.**

| Health state | Undercooling | Cooling | Health | Heating | Overheating |
|--------------|--------------|---------|--------|---------|-------------|
| Threshold    | [−∞, 0.450]  | (0.450, 1.458] | (1.458, 3.472) | [3.472, 4.479) | [4.479, +∞) |

**Results and Analysis**

**Dynamic Evolution Analysis of the REM Health in Shandong Province**

Based on the data of Shandong from 2006 to 2015, using the above analysis methods, we compare the annual health value with the health threshold in Table 2 to find out the corresponding interval, and then to judge the market health state of every year. Hereby, the REM basic situation and problems are researched. The calculation results are shown in Table 4.

**Table 4. Health State of the REM in Shandong Province.**

| Year | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|------|------|------|------|------|------|------|------|------|------|------|
| Health value | 3.789 | 5.525 | 5.679 | 4.927 | 4.242 | 4.948 | 3.502 | 3.728 | 3.004 | 2.680 |
| Health state | Health | Heating | Overheating | Heating | Health | Heating | Health | Health | Cooling | Undercooling |

Overall, from 2006 to 2015, the health state of Shandong REM tended to be stable. Although there was ups and downs during the period, the fluctuation range was getting smaller and smaller. This shows that the REM is gradually improving with the time processing. Except for 2 years being in an unhealthy state, the REM in the remaining years is generally in good condition, with 4 years in a health state. According to the changing trend of the REM health value over the years, it can be divided into four stages: Rapid rise stage (2006~2008); Rapid decline stage (2008~2010); Small fluctuations stage (2010~2013); Steady decline stage (2013~2015). Correspondingly, the operating state of the REM went through four stages of rapid heat-up, rapid cooling down, healthy fluctuation and steady cooling.

From 2006 to 2008, affected by the prosperous supply and demand, the market gradually became heating till overheating. The price of commercial residential buildings increased 18.79% from 2400.44 yuan/m² in 2006 to 2851.40 yuan/m² in 2008. After 2008, faced with the impact of the international financial crisis, the slump in the macro-economy hindered the supply and demand of the REM. Shandong REM entered the rapid cooling down stage (2008~2010); From 2010 to 2013, the REM regulation policies tightened further and then the REM in general is in good health and has been gradually improved; Since 2013, China's economic and social development has entered a new phase and the downward pressure on the domestic economy has increased. Coupled with the further strengthening of the supply side reform of the REM, supply and demand were both suppressed. So Shandong REM has been running in a cooling state, but the overall operation was relatively stable with no large fluctuation.
From 4 levels of the REM, the most important factor affecting the trend of the comprehensive health value is the supply-demand level, with a correlation coefficient of 0.9886, followed by the price level. This shows that the supply-demand and the price are significant factors affecting the health state of Shandong REM. In terms of changing trend of each level, health fluctuation of the supply-demand level is the largest. On the one hand, the slowdown of the national economy has restrained the REM supply. On the other hand, the improvement of urbanization has stimulated the REM demand. The combination of the two aspects has led to a slight unhealthy state of the supply-demand level; Health fluctuation of the price level is relatively small, indicating that Shandong REM tends to be healthy in price; Health fluctuation of the structure level is the smallest, which means that the REM run smoothly in the investment structure, product structure and consumption structure; The REM at the speed level has weaker fluctuation, illustrating that real estate development was stable and basically coordinated with the national economic growth.

**Spatial Difference Analysis of the REM Health in Shandong Province**

By the end of 2015, overall, the REM in Shandong Province stabilized and the investment continued for a long time. The average price of commercialized housing in Shandong Province (5290.06 yuan/m²) was lower than the national average of 6473.51 yuan/m². However, the development of REM in different cities is not balanced.

![Figure 1. Health Value Distribution of the REM in 17 Cities of Shandong Province.](image)

In 2015, among the 17 cities of Shandong, the REM in most cities is in good condition. There were 12 cities in health state, namely Jinan, Zibo, Dongying, Yantai, Weifang, Taian, Laiwu, Linyi, Dezhou, Liaocheng, Binzhou and Heze. As a economically developed first-tier city, Qingdao's REM showed a heating state, mainly due to the overheating at the price level and the speed level. In 2015, the housing price of Qingdao was 8,436.59 yuan / m², and the housing price to income ratio was 7.599, beyond the reasonable range. These two indicators are ranked first in the whole province; Rizhao REM was overheated as a whole. The main reason is the supply-demand level overheating, where market supply greatly exceeded the market demand. In 2015, the floor space of residential buildings completed in Rizhao increased by 67.36%, while the urban population increased by only 4.33%; In general, the REMs of Zaozhuang, Jining and Weihai were in cooling state. The common reason is that REI growth slow, lagging behind the national economic growth and urban population growth. In 2015, the growth rate of residential investment in the three cities dropped by 12.16%, 6.7% and 12.3% respectively. While GDP growth rate increased by 7.07%, 8.40% and 8.50% respectively, and the growth rate of urban population increased by 5.41%, 5.72%, 2.87%.

**Conclusion and Policy Suggestions**

In this paper, we attempt to establish a relatively complete health evaluation system of REM in Shandong Province, from 4 levels of price, structure, speed and supply-demand to investigate the REM running state. This creates a condition for in-depth analysis on the health of Shandong REM.
Through the empirical analysis of the time series and spatial differences of the REM in Shandong, the following conclusions and suggestions are drawn:

(1) For Shandong Province, price level is the primary factor affecting the health of the REM, with a weight of 0.5456, followed by Supply-demand level. Therefore, in order to promote the REM development healthily, two regulation measures should be strengthened. One is to curb excessive growth in house prices, and the other is to strengthen supply-side structural reform so as to control the scale and speed of REI.

(2) From the dynamic evolution analysis, it can be seen that Shandong REM overall tended to be stable and cooling, although there was fluctuation, the fluctuation range became lower and lower. Fluctuation of the supply-demand level is the highest, followed by the price level, and the structure and speed level fluctuation is the lowest. This also shows that supply-demand and price levels are the focus of REM regulation in Shandong.

(3) From the spatial difference analysis, it can be seen that the development of the REM in 17 cities of is unbalanced. As an developed eastern city, the government should moderately increase the housing construction to meet the urgent purchase needs of urban residents, in addition to cracking down on speculation. As an underdeveloped western city, the government should speed up real estate development to meet the increasing urbanization level, making the real estate development and the national economic development complement each other.

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