Specification of the Real Estate Cycle in China from 1986 to 2008
——Based on the Diffusion Index Method

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Abstract: This research establishes a diffusion index system of real estate cycle by using Delphi and empirical analysis methods. Evidences are obtained from China's real estate market through a case study. Using optimized diffusion index we analyze the phases, fluctuation patterns, and other features of the real estate cycle in China. The conclusions are as follows. (1) from 1986 to 2008 the real estate industry in China has experienced four typical cycles as 1986~1990, 1990~1994, 1994~1999 and 1999~2008; (2) the real estate cycle in China is consistent with its macroeconomic cycle by demonstrating a significantly smaller amplitude in the third and fourth cycles and a longer wavelength in the fourth cycle. This supports the notion that market-oriented reforms have smoothed cyclical fluctuations. (3) combined with analysis of policy factors and macroeconomic variables, it shows that China's real estate cycle remains significant features of policy cycle and it can be explained by the Impact-Transmission Mechanism Hypothesis.

Keywords: Real Estate Cycle; Diffusion Index; Macroeconomy; Delphi Method

1. Introduction

Being an important component of macroeconomy and subjected to various kinds of internal and external factors, real estate industry has the characteristic of cyclical fluctuation as macroeconomy does. China's real estate industry has experienced the recovery and huge prosperity in 2009 after the periods of rapid growth in 2007 and sharp decline in 2008. The growth rate of real estate market in 2009 is even much larger than that of 2007 which shows that the volatility of real estate market is increasing after year 2007. The government has issued series of tightening policies aiming at controlling the rising house prices and preventing the possible bubbles in real estate market. Recently, the effects of regulating policies gradually emerge and the strong expectant atmosphere flood in real estate market. What does the future of China's real estate market look like? To answer this question requires specification of real estate cycle and analysis of its features and driving factors by adopting quantitative methods.

The remainder of the paper is organized as follows. In section 2, we construct a diffusion index system of real estate cycle by using Delphi and empirical analysis methods. Using the optimized diffusion index we analyze its phases, fluctuation patterns and other features of real estate cycle in China from 1986 to 2008 in section 3. Section 4 provides conclusions.

2. Construction of Diffusion Index System of Real Estate Cycle in China

2.1. Diffusion Index Method

Diffusion index method is proposed by the eco-

nomic statistician Moore from the National Institute of Economic Research (NBER) of the United States. Its basic principle can be described as follows. Normally using a single economic variable is not enough to represent all the fluctuations in the economic process. On the contrary, cyclical fluctuations transfer and spread through a series of economic activities. The diffusion index method determines whether the economy is in expansion by checking the proportion of growing indicators of all at the same point. If each indicator weights the same, the formula of diffusion index can be written as:

$$DI(t) = \frac{\sum_{i=1}^{N} I(X_i(t) \geq X_i(t-j))}{N} \times 100\% \qquad (1)$$

Where, $DI(t)$ is the diffusion index. $X_i(t)$ denotes fluctuation value of indicator i at time t. N is the number of all indicators, J is the time interval between the two comparative indicator values, and I is the characteristic function. Then we compare the value of indicator i at time t and t-j. If the value of time t is bigger, the economy is in the expanding phase, and we make I=1. When the value of time t is smaller, the economy is in the contracting phase, we make I=0. The remaining possibility that the value of the two period is the same, we make I=0.5.

As the effect on diffusion index exerted by the different degrees of expansion is not considered, the traditional diffusion index method often tends to magnify the occurring minor increases to prosperity peaks, or see the minor declines as the deep trough, and then errors emerge. In order to avoid this, Li Bin, etc. (2003) im-

prove the diffusion index method and the optimized diffusion index can be illustrated as follows:

Fluctuation intensity index $U_{p_i t}$ is defined as:

$$U_{p_i t} = \begin{cases} 0.5 - (u_{it}/c_i)^l & u_{it} < 0 \\ 0.5 & u_{it} = 0 \\ 0.5 + (u_{it}/c_i)^l & u_{it} > 0 \end{cases} \quad (2)$$

Where u_{it} is the fluctuation rate of indicator $X_i = (x_{i1}, x_{i2}, x_{i3}, \cdots, x_{im})$, namely:

$$u_{it} = (x_{it} - x_{it-1})/x_{it-1} \quad (3)$$

Where c_i is defined as the maximum or minimum value of fluctuation rate u_{it} at different period, namely:

$$c_i = \begin{cases} Min(u_{it}) & u_{it} < 0 \\ Max(u_{it}) & u_{it} > 0 \end{cases} \quad (4)$$

Where l is the preference operator, reflecting the role of subjective factors. It can be determined by the growth pattern of indicators' growth rate in the previous stage. When it conforms to the geometric pattern, we make l = 1. If it conforms to the pattern that the increase rate of the former phase is faster while that of the later phase is slower, an appropriate value can be chosen in the interval of (0,1). When it conforms to the pattern that the growth speed of the later phase is faster while that of the former phase is slower, we give l the regarding value under the condition of l >1, however l should not be larger than 3 generally. Then the formula of optimized diffusion index can be given as follows:

$$DI = \sum_{i=1}^{n}(w_i U_{p_i t} / \sum w_i) \quad (5)$$

Where w_i and n are defined as indicators' weight and the number of original indicators for calculation of *DI* respectively.

2.2. Construction of Real Estate Cycle Index System

According to existing references and results of empirical analysis, 32 indices are preliminary selected. Then we use Delphi method and choose indices based on the opinions of experts and the availability of data[1]. (1) For low representativeness and necessity of completed value of commercial housing index and amount of work force of real estate industry index, and low representativeness

of gross amount of personal housing savings and loans index, these three indices are dropped. (2) Because of high correlation of the two indices, respectively developed land area and gross land grant area, and the former index's comparatively high representativeness, necessity and availability, the developed land area index is chosen. (3) Considering the poor availability of the data of sale number of commodity residence, this index is removed. (4) Gross amount and self-raised funds in real estate development investment show high correlation, so the classification indices, self-raised funds in real estate development, etc., have been kept. (5) All the price index data are incomplete in time series, so they are not suitable as indices of real estate cycle diffusion index system. (6) Finally the sale price of commercial housing index is kept while the three classification indices, sale prices of commodity residence, commercial operating house and commercial office building, are removed because the sale price of commercial building index has good representativeness, necessity and availability according to the experts' opinions. In summary, a real estate cycle diffusion index system which includes 6 criteria layers and 17 indices has been finally established (see table 1).

Table 1 Real Estate Cycle Diffusion Index System

Criteria Layers	Weights	Index layers	weights
Gross Amount	0.139	Added value of real estate industry	0.100
		The number of real estate development company	0.039
Investment	0.180	Real estate development investment	0.068
		Profit from operation of real estate company	0.033
		Developed land area of real estate company	0.041
		Gross amount of land grant fee	0.038
Production	0.145	Newly Constructed floor area of commercial housing	0.053
		Construction area of commercial housing	0.050
		Completed floor area of commercial housing	0.042
Transaction	0.195	Sale area of commercial housing	0.070
		Sale amount of commercial housing	0.068
		Land transfer area	0.057
Finance	0.138	Domestic loans in real estate development investment	0.060
		Foreign funds in real estate development investment	0.039
		Self-raised funds in real estate development investment	0.039
Price	0.203	Sale price of commercial housing	0.113
		Land purchase price	0.091

We issued the indices weight questionnaires to 15 experts and received 15 valid questionnaires. By using

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[1]Questionnaires were issued to 18 experts and a total of 15 valid ones were responded. The fields and numbers of the experts are as follows: real estate economics(8), real estate investment(2), land economics(2), urban economics(1), macro-economics(1) and economic statistics(1).

Delphi method, we ascertain the weights of all the 17 indices as follows (see table 1).

The data of the 17 indices are from "China Statistical Yearbook", "China Land Resource Statistical Yearbook", China economic information statistics database, "Real Estate development Statistical information Compilation from 1986 to 1995" and "Fifty years of New China Statistics data compilation".

2.3. Establishment of the Optimized Diffusion Index

We use the chain growth rate of the 17 indices to calculate the diffusion index. Since most growth patterns of indices show faster growth rate in prophase and slower growth rate in the later, according to optimized diffusion index method we make l =0.8, which is also based on the research of Li Shaosong and Wang Yousong (2007). The optimized diffusion index has been established (see figure 1).
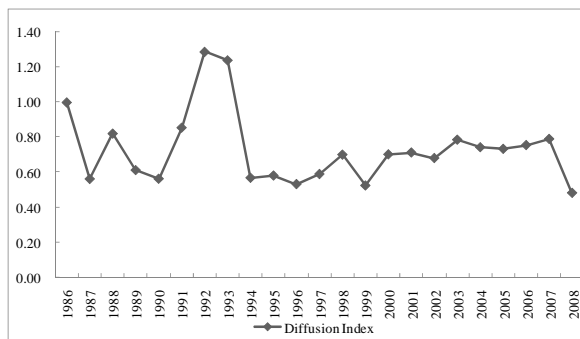

Figure 1. Real Estate Diffusion Index in China 1986~2008

3. Further Analysis of China Real Estate Cycle

3.1. Division of Different Phases of China Real Estate Cycle

Based on the Trough-to-Trough division method, real estate industry in China from 1986 to 2008 has experienced four typical cycles (see Figure 1). The first cycle is from 1986 to 1990 when China real estate industry began to decline in 1987 and then fell to the deep valley in 1990. The second cycle is from 1991 to 1994 when the recession of China real estate industry began after reaching its peak in 1992, then dropped to the bottom in 1994. The releasement of "Urban State-owned Land Use Right Grant and Transfer Interim Regulations" in 1990 marked the marketization period of the land market development. The third cycle is from 1995 to 1999 when China real estate industry reached its peak in 1998 and then fell into the trough in 1999. It marked the transfer of China housing market from welfare housing stage to commercial

housing stage when "On Deepening the Urban Housing System Reform's decision from State Council" released in 1994. Stimulated by this policy, the market recovered from the trough. The fourth cycle is from 2000 to 2008. Since 2003, the state has issued series of regulatory policies to promote the healthy development of real estate industry. China real estate industry has experienced the steady growth with its peak in 2007 and its trough in 2008.

3.2. Comparative Analysis of China Real Estate Cycle

The added value of real estate industry reflects the synthetic operation status of the whole industry, which represents real estate cycle fluctuations to a certain extent. We compare the curves of diffusion index and chain growth rate of added value of real estate industry in Figure 2. Although there are some differences, the general trend of two curves is almost the same. The trough of the first cycle based on the curve of diffusion index is 1990, while that of chain growth rate of added value has its trough in 1991 and its peak in 1992. What's more, the curve of diffusion index shows more volatility than that of chain growth rate of added value on the whole.
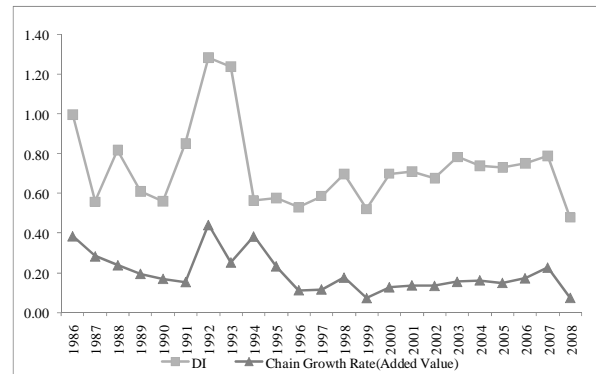

Figure 2. Diffusion Index and Growth Rate of Added Value of Real Estate Industry

As an important component of macroeconomy, real estate market has been deeply affected by the changes of macroeconomy. We put the curves of diffusion index and chain growth rate of GDP together in Figure 3 for comparison. As shown in Figure 3, the trend of fluctuations generally remained the same between the two curves and the macroeconomic cycles keep ahead of real estate cycles by two years. And also real estate industry's recovery and recession are respectively sooner and later than its macroeconomic counterpart. For instance in 1986, real estate industry went down, while macroeconomy was still growing. It happened in 1993 too. From 1996 to 1998, macroeconomy was in the trough due to the impact

of Asian financial crisis while during this period, the housing system reform was in progress and real estate investment was strengthened in order to stimulate the economic development. Thus different from macroeconomic cycle, real estate cycle shows the opposite trend in this phase. In addition, it is clear that real estate cycle in China, consistent with macroeconomic cycle, shows the steady tendency with evidences that the amplitudes of the third and fourth cycle are significantly less than that of the former two cycles and the wavelength of the fourth cycle is longer than that of the first three cycles which indicates that the market-oriented reforms have smoothed cyclical fluctuations.
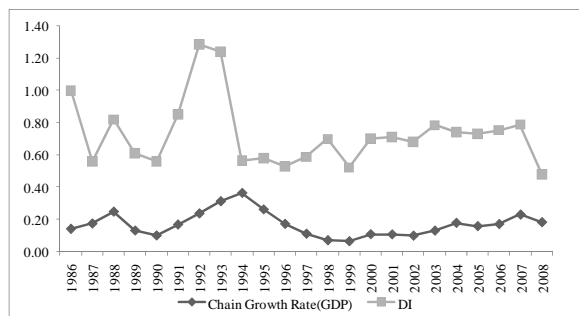

Figure 3. Diffusion Index and Growth Rate of GDP

3.3. Explanation of China Real Estate Cycle

From the above, China real estate industry is affected by macroeconomy and regulatory policies as well. Not only can China real estate cycle be explained by Impact-Transmission Mechanism Hypothesis, but also remains significant feature of policy cycle. On the one hand, real estate development is closely linked with macroeconomy. In the wake of the Asian financial crisis in 1999, China real estate industry fell to the bottom of trough, and the industry dropped to the bottom again owing to the financial crisis in 2008, which are both consistent with Impact-Transmission Mechanism Hypothesis, meaning that China real estate industry is influenced by macroeconomy to a large extent. On the other hand, two important policies in 1990 and 1994 respectively promoted the recovery of China real estate industry and stimulated the development. Since year 2000, the state has come up with series of policies which provided the solid basis of steady development of real estate industry to support the healthy development of the industry. Combined with the actual situation of 2009 and 2010, macro-regulation policies issued in this period had a profound impact on the development of real estate industry. As a result, periodical fluctuations also closely relate with policy factors.

4. Conclusions

By using Delphi method, this research establishes a diffusion index system of real estate cycle and determines the weights of each index. Using optimized diffusion index, we conclude that the real estate industry in China from 1986 to 2008 has experienced four typical cycles as follows. The first cycle is from 1986 to 1990 with its trough in 1990. The second one is from 1991 to 1994 with its trough in 1990. The third one is from 1995 to 1999 with its trough in 1999. And the fourth one is from 2000 to 2008.

Combined with real estate policies in China, the comparative analysis of real estate cycle diffusion index, chain growth rate of added value of real estate industry and GDP shows that: (1) although closely linked with macroeconomic cycle, real estate cycle is often not synchronized with it. (2) China's real estate cycle remains significant feature of policy cycle and it can be explained by Impact-Transmission Mechanism Hypothesis. (3) China's real estate cycle is consistent with its macroeconomic cycle by demonstrating a significantly smaller amplitude in the third and fourth cycles and a longer wavelength in the fourth cycle. This supports the notion that market-oriented reforms have smoothed cyclical fluctuations.

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