CASE STUDIES OF THE EFFECTS OF SPECULATION ON REAL ESTATE PRICE BUBBLE FORMING: BEIJING AND SHANGHAI (2001~2010)

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ABSTRACT

From the angle of economic development, a certain degree of real estate bubble is beneficial to the overall real estate market. However, if the bubble inflates too fast and even goes out of control, a serious economic crisis will take place after the bubble deflates. The rare land, the expansion of real estate speculation and the excess lending are conceived as the main reasons that bring about a real estate bubble. Real estate speculation will bring treat to the sustainable, stable and balanced development of real estate market. This paper aims at analysing the effects of speculation on real estate price bubble forming in Beijing and Shanghai real estate market in accordance with the statistical data (2001~2010).By respectively examining the speculation levels and bubble levels of the real estate markets in two cities, the study finds that the degree of real estate bubble in Beijing is higher than that in Shanghai and the bubble has an overall expansion tendency; the speculation level in Shanghai is higher than that in Beijing, but they are thought to be not serious, what's more, Beijing has the stronger effect of the speculation on housing bubble forming than that of Shanghai. At last, the study suggests that the government should make efforts to curb the real estate speculation for a healthy and stable real estate market.

 Keywords: Real Estate Bubble; Speculation; Housing Price; Real Estate Market

INTRODUCTION

The real estate development is essential to the macroeconomic development of a country. A rapid real estate development will enhance economic development; on the contrary, if the real estate development remains stagnant, it will adversely affect the development of national economy. However, with the development of real estate industry, some investors have found the appreciation potential, resulting in the large capital inflows in real estate market; housing prices continuously rise out of market, causing a real estate bubble forming. From the angle of economic development, a certain degree of bubble existing in real estate market is likely to promote the development of national economy, but if the bubble inflates too fast and even goes out of control, a serious economic crisis will take place after it deflates. Some cases can show the serious effects of real estate bubble on economy, for instance, the Japanese real estate bubble (1990s), the real estate bubble of Hainan, China (1992~1993), the Asia economic crisis (1997), and the American subprime mortgage crisis (2008). The most famous case is the Japanese real estate bubble. When the bubble burst in 1990, bad debts brought the banking system close to collapse, and Japan, therefore, fell into a decade of recession and deflation, which sounds the alarm to many countries around the world.

With the progress of urbanization accelerated, Chinese real estate is developing fast, and the housing prices are trending upwards, thus many investors have the expectancy that the housing prices of big or medium-sized cities will be growing. Prompted by benefits, they invest on a large amount of capital in housing market, which adds instable factors to housing prices. Many scholars give their opinions to estimate whether the development of Chinese real estate is healthy or not, raising a fierce contention about real estate bubbles. Generally, a real estate bubble is a kind of economic bubble occurring periodically in real estate markets. It is a process of continual price rising detached from real value and the excess of sales over the moderate price dictated by market. Entering into the 21th century, the real estate in mainland China is developing quickly, the commodity housing prices in a few big cities like Shanghai and Beijing are to approach the level of the developed countries, which has caused a worldwide concern.

The researches on bubble in western field of economy focused on stock market in theoretical analysis and comparative study rather real estate price bubble. Kindleberger (1989)[1] argues that inside investors raise the assets prices through property speculation and sell them at higher prices to outside investors; the outside

investors buy the assets at high price and have to sell them at low price. In the period of economic expansion, speculators usually have "naive expectation"—the prosperity will be ongoing indefinitely, so the initial speculators may sell their assets to those who have the risk preference, and then they benefit from it. Obviously, the formation of real estate bubble is closely linked with speculations.

Especially in recent years, China's real estate prices and investment have been raised rapidly, some professionals start debating about whether the speculations are serious and whether the developments of real estate market overheat or not. In 2008, the economic crisis happened in the United States was throughout the world, and it brought about serious effects on China's real estate. If an excess bubble exists in China's real estate market, the economic development will be affected seriously with the housing bubble popped. Facing this fact, the paper chooses two first-tier cities, Beijing and Shanghai, as research objects, uses the statistics data from 2001 to 2010, respectively measures the speculation degree and the bubble degree of the real estate markets of two cities based on index method and modelling method, and analyses the relevance of housing speculation and housing bubble in two cities so as to give a policy recommendation of the inhibition of the housing bubble. This paper is divided into four parts. The next part is the review of research advances which mainly summarizes scholars' researches; the third section respectively measures bubble degree and speculation degree of real estate market in Beijing and Shanghai by using index method and modelling method, and makes a empirical study on the relevance of speculation and bubble forming of real estate market in two cities; the last section gives some policy suggestions according to analytical results.

ADVANCES OF THE STDUY ON REAL ESTATE BUBBLE

The studies on the measurement of housing bubble have been progressing fast in recent 30 years, which can generate progress in theory, methodology and application. This section makes the induction and analysis of the present researches by reviewing domestic and foreign achievements, giving theoretical support to this paper.

The study on real estate bubble, either in methodology or in overall frame, borrows the research methods and concepts of financial asset bubble. Before the 1980s, economists around the world mainly made the qualitative description and analysis of asset bubbles [2]. However, the systemic research on bubble phenomenon was started with studying on "rational bubble" in the early 1980s [3]. Internationally, the study is generally aimed more at stock markets than housing markets. Since 1990s, affected by the Japanese estate bubble, the Asia financial crises and the American subprime mortgage crisis, the researches of real estate bubble have received a wide publicity and made great advances. For now, the studies on the existence, the determination method of bubble and the influencing factors of real estate bubbles are three main contents.

The research on the existence of real estate bubbles began relatively early in abroad. Naguchi Yokio (1987) measured the existence of housing bubbles [4]; Kim and Suh (1993) found that the housing prices of Japan and Korea skewed off from a long period of balanced standard [5]; Bertrand (1999) examined the housing bubbles at the level of the twenty districts of Paris from 1984 to 1993 in order to get insight into the spatial mechanism of speculative bubbles [6]; Abraham and Hendershott (1996) [7], Case and Shiller (2003) [8] and Allen and Thomas (2008) [9] researched on the measurement of speculation bubbles in American real estate market; Kim (2004) [10] also measures the Korean housing bubbles.

For the determination method of bubble, Naguchi Yokio (1987) propounded a method of measuring bubbles by discounted cash flow analysis; Wong (2001) [11] created a dynamic model based on Thailand housing bubbles, showing the motive mechanism of "group action" caused by the optimistic expectancy of land agents and residents in the process of the bubble production and expansion; Chan, Lee and Woo (2001) [12] measured the rational bubbles of Hong Kong housing market by econometrics model; Shimizu and Kiyohiko (2007) [13] analysed the indices of Japanese urban land prices to measure housing bubbles and found the significant structural changes in price structure, indentifying pre-bubble, bubble and post-bubble periods.

About the influencing factors of real estate bubbles, Kazuo Sato (1995) [14] studied on the supply-demand relation of Japanese housing market and points out that housing bubble is caused by the expectancy of price growth; Edward (2008) [15] argued that housing bubble was easy to form in the housing market which had small price elasticity of supply; Lee and Ong (2005) [16] found that housing demand and the positive feedback mechanism of housing price caused the real estate bubble; Macro-economically, Krugman (1999) [17] stated that the common ground of all housing bubbles was that the investing funds are accommodated by banks; Allen and

Gale(1998) [18] illustrated that the problems of financial intermediary agencies resulted in forming the asset bubbles; asset prices were related to credit quota, and the uncertainty of the return on assets causes asset bubbles; Gerlach and Peng (2005) [19] studied on the relationship between residential property prices and bank lending in Hong Kong; Leung (2004) [20] provided a selective survey of the small but nascent research efforts focused upon interplay between the housing market and macro-economy.

The researches on real estate price bubbles in China began after housing reform in the late 1990s, Zhou (2004) [21] argued that speculation would cause economic fluctuation and propel the asset bubble forming; Wu and Wang (2006) [22] stated that the most direct reason for real estate bubble was the over speculation and build a measuring model of speculation bubble; Xiao (2010) [23] analysed the degree of real estate speculation in the case of Shanghai real estate market, giving some suggestions about controlling housing prices.

This paper also refers to two similar researches. Lai, Xu and Jia (2009) [24] established a regression model of real estate price with economic variables and built the econometric model to measure real estate's speculative bubble of Chongqing city; Hou (2010) [25] examined whether housing price bubbles existed in Beijing and Shanghai and showed that Beijing appeared to have been on the way of forming a housing price bubble between 2005 and 2008, and found that a housing bubble perhaps existed in Shanghai from 2003 to 2004, besides, Beijing housing market was divided into 3 stages due to bubble forming: cycle peak stage (1991-1997) , cycle trough stage (1998-2003) and the second cycle peak stage (2004-2008).

The research topics of the above two papers are similar to this study. However, by contrast, this paper makes combination of the study on real estate speculation and real estate bubble and mainly researches the effects of speculation on the real estate bubble forming by respectively measuring the speculating and bubble levels of Beijing and Shanghai. Then, this study not only examines the speculative level of Beijing and Shanghai but also respectively examines the increased portion of housing price caused by speculation and the proportion of "speculative price" in annual average housing price of Beijing and Shanghai so as to make the study accurate. In addition, in the process of measuring real estate bubbles of two cities, the study chooses five indices instead of modelling method in order to directly illustrate existing problems, meanwhile, by reviewing the change situation of indices around the safety value, the study also measures both the annual average "bubble level" of and the 10-year average "bubble level" of Beijing and Shanghai.

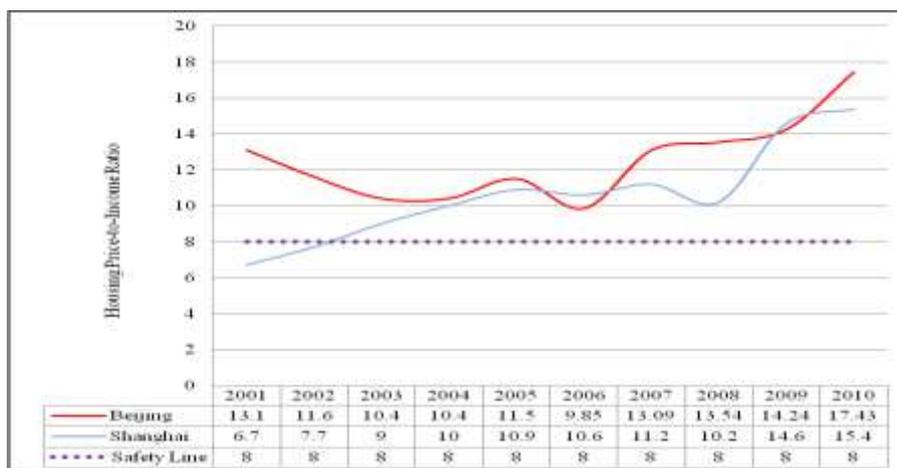## MEASUREMENT OF REAL ESTATE BUBBLE AND SPECULATION LEVEL

There are generally two methods to measure the degree of real estate bubbles, index method and modelling method. Index method is to judge whether the real estate bubbles exist in housing markets or not by analysing different indices. This method is relatively easy and can directly illustrate problems. Modelling method has essential measuring and evaluating system through modelling based on theory. According to practical circumstance, the study is to observe the annual real estate bubble levels of Beijing and Shanghai from 2001 to 2010 by examining the change of indices around the safety line, therefore, the study choose index analysis method to measure the real estate bubble level of Beijing and Shanghai from 2001 to 2010. Additionally, the study will also calculate the proportions of the increased prices caused by speculation in the annual housing prices while measuring real estate speculation level of Beijing and Shanghai from 2001 to 2010.

Measurement of Real Estate Bubbles

According to Ren and Wang (2008) [26], the indices "housing price-to-income ratio", "housing price growth rate-to-GDP growth rate ratio", "real estate investment growth rate-to- GDP growth rate ratio", "total investment in real estate-to-investment in fixed assets ratio" and "construction area-to-completed area" ratio can well reflect the real estate bubble level. Thus, the study will analyse the five indices respectively basing on the real situation of Beijing and Shanghai real estate market from 2001 to 2010, measuring the changing situation of housing bubble and the 10-year average bubble level by examining the change of index values around the safety line. Through this way, the study will know the operation situation of the real estate economy in Beijing and Shanghai during the last decade.

Housing Price-to-Income Ratio

The index "housing price-to-income ratio" can show family payment capacity. Higher housing price-to-income ratio means lower payable capacity. When the ratio increases continuously, the level of the needs of speculation in housing market become higher, causing a possibility of housing bubble forming. Internationally, the safety value of housing price-to-income ratio in developing countries is "7". According to the characteristic housing system and the "invisible income" in China, it should be much bigger than "7". Academically, the safety value of the index in China is "8". Fig.1 shows the housing price-to-income ratio of Beijing and Shanghai from 2001 to 2010. Obviously, the changing curve of Beijing is above the safety line; the ratio value increases from 2006 and reach the peak in 2010. The housing price-to-income ratio value of Shanghai is above the safety line from 2003 to 2010 and reaches the peak also in 2010. Especially, the ratio has a rapid increase in both Beijing and Shanghai from 2008 due to U.S. financial crises. It is found that the payment capacities of the families in two cities are relatively weak, moreover, the housing price is not rational and the housing bubble exists in markets.
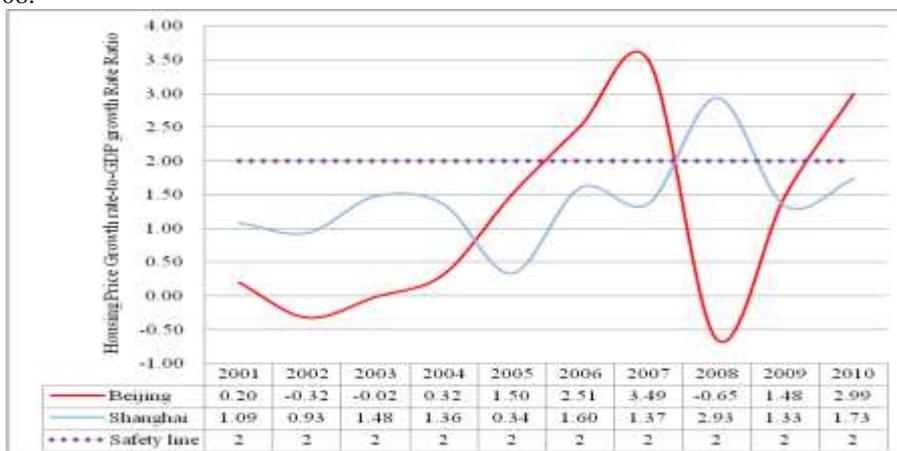

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Beijing	13.1	11.6	10.4	10.4	11.5	9.85	13.09	13.54	14.24	17.43
Shanghai	6.7	7.7	9	10	10.9	10.6	11.2	10.2	14.6	15.4
Safety Line	8	8	8	8	8	8	8	8	8	8

Source: Beijing Statistics Yearbook(2011); Shanghai Statistics Yearbook(2011) (arranged by the study)
Fig.1. Housing price-to-income Ratio of Beijing and Shanghai.

Housing Price Growth Rate-to-GDP Growth Rate Ratio

This index mainly shows the expansion level of housing bubble and can be usually used to examine the bubble level. Internationally, the safety value of the index has no strict standard. Generally, when the housing price increases 2 times more than the GDP growth rate, the housing price seems to be not reasonable due to the existence of housing bubble. As shown in Fig. 2, Beijing and Shanghai have basically kept a healthy economy development. In 2006 and 2007, however, the ratio value of Beijing beyond the safety line, and its GDP had a great growth because of the 2008 Beijing Olympic Games, which makes the ratio value decreases under the safety line greatly in 2008 but increases again from 2009.The ratio value of Shanghai beyond the safety line only in 2008.

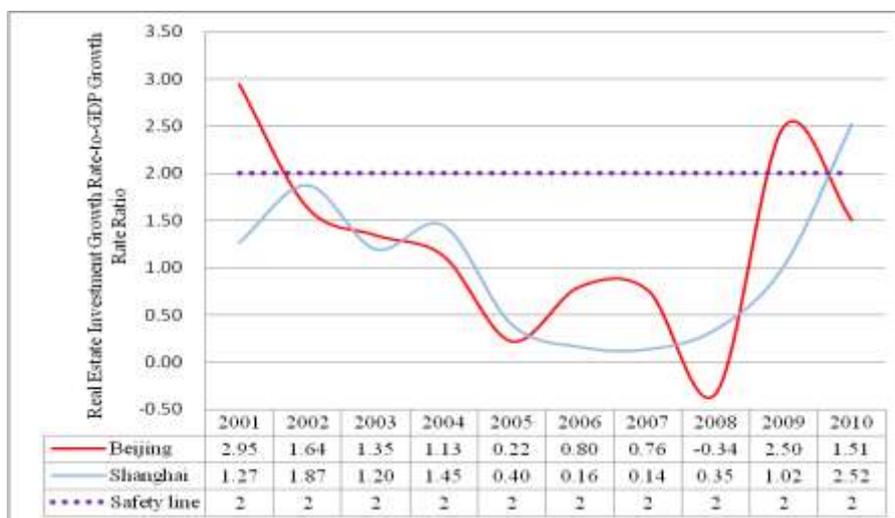|	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Beijing	0.20	-0.32	-0.02	0.32	1.50	2.51	3.49	-0.65	1.48	2.99
Shanghai	1.09	0.93	1.48	1.36	0.34	1.60	1.37	2.93	1.33	1.73
Safety line	2	2	2	2	2	2	2	2	2	2

Source: Beijing Statistics Yearbook(2011); Shanghai Statistics Yearbook(2011) (arranged by the study)
Fig.2. Housing Price Growth Rate-to-GDP Growth Rate Ratio

Real Estate Investment Growth Rate-to-GDP Growth Rate Ratio

Real estate investment is able to reflect the supply-demand relationship of housing market. If the investment increases rapidly, the demands of housing speculation will be also increased. Thus, it is the basic index that examines whether the investment structure in various fields of national economy is rational or not and whether the expansion of housing investment exceeds the rational standard or not. Generally, only if the ratio value is less than 2, the real estate investment growth rate is in a healthy situation. As shown in fig.3, from 2001 to 2010, the real estate investment growth of Beijing and Shanghai is generally in a normal condition.
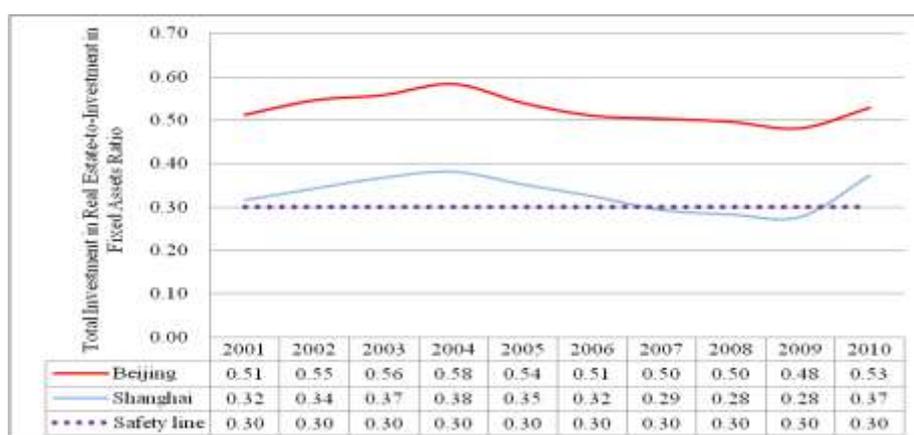

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Beijing	2.95	1.64	1.35	1.13	0.22	0.80	0.76	-0.34	2.50	1.51
Shanghai	1.27	1.87	1.20	1.45	0.40	0.16	0.14	0.35	1.02	2.52
Safety line	2	2	2	2	2	2	2	2	2	2

Source: Beijing Statistics Yearbook(2011); Shanghai Statistics Yearbook(2011) (arranged by the study)
Fig.3. Real Estate Investment Growth Rate-to-GDP Growth Rate Ratio

Total Investment in Real Estate-to-Investment in Fixed Assets Ratio

This ratio shows how much cash flow in the real estate industry. In developed countries, the index is usually between 0.2 and 0.25. As China is a developing country which is in a rapid development and urbanization process, the demands to real estate investment are larger than other countries. Academically, we choose 0.3 as the safety value of this index. From fig.4, it is obvious that the real estate investment of both Beijing and Shanghai accounts for a higher proportion in fixed assets investment, especially, the real estate investment in Beijing accounts for more than 50% of the fixed assets investment.
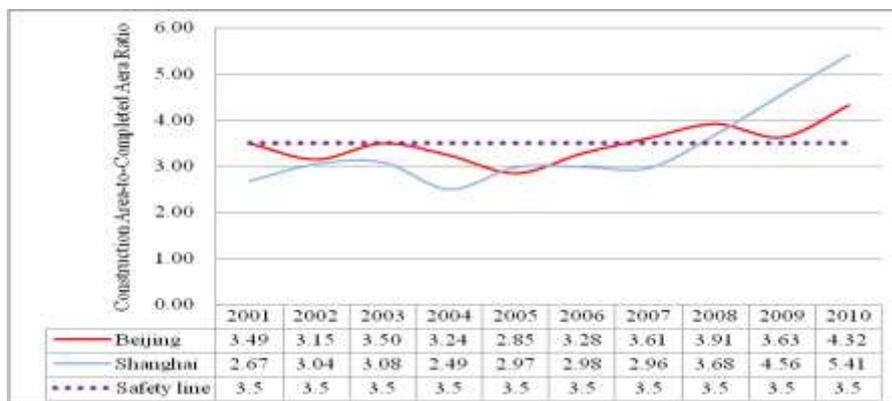

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Beijing	0.51	0.55	0.56	0.58	0.54	0.51	0.50	0.50	0.48	0.53
Shanghai	0.32	0.34	0.37	0.38	0.35	0.32	0.29	0.28	0.28	0.37
Safety line	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30

Source: Beijing Statistics Yearbook(2011); Shanghai Statistics Yearbook(2011) (arranged by the study)
Fig.4. Total Investment in Real Estate-to-Investment in Fixed Assets Ratio

Construction Area-to-Completed Area Ratio

This index is used to reflect the investment level and the supply-demand situation in future housing market. The construction area is generally 3.5 times more than the completed area, which show the housing supply in the next 1 or 2 years. The higher the ratio is, the more serious the bubble is. Fig.5 shows that the housing supply of

Beijing and Shanghai is generally in a rational standard during 2001 and 2007, whereas, the housing supply has become obviously increase from 2007, which may cause a housing bubble forming.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Beijing	3.49	3.15	3.50	3.24	2.85	3.28	3.61	3.91	3.63	4.32
Shanghai	2.67	3.04	3.08	2.49	2.97	2.98	2.96	3.68	4.56	5.41
Safety line	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5

Source: Beijing Statistics Yearbook(2011); Shanghai Statistics Yearbook(2011) (arranged by the study)
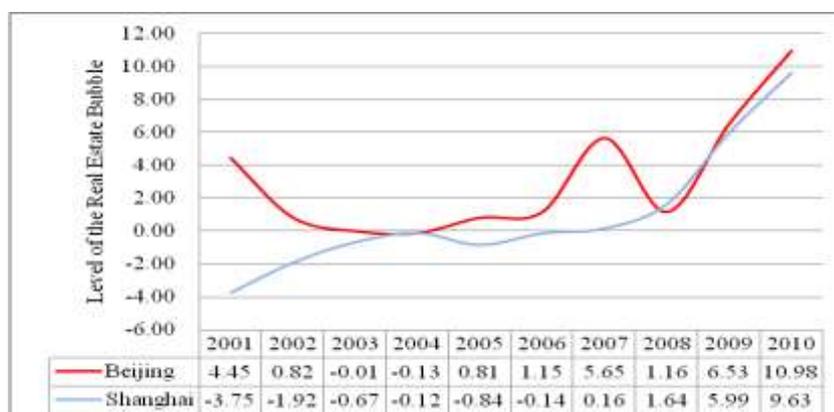**Fig.5.** Construction Area-to-Completed Area Ratio

In order to measure the housing bubble level of Beijing and Shanghai, this study analyses the 5 key indices and utilizes the extend that the 5 indices of two cities flow above or below the safety value to examine the housing bubble level of Beijing and Shanghai from 2001 to 2010. The calculation formula is as follows.

$$B_t = \sum_{i=1}^{10} \sum_{j=1}^{5} (V_{tj} - S_j)$$

(1)

Where

B_i: Bubble level at year i

V_{ij}:   Value of index j at year i

S_j: Safety value of index j

i: 2001, 2002,…, 2010

j: Index1, index2,…, index5

The bubble levels of Beijing and Shanghai from 2001 to 2010 are calculated and shown in fig.6. It is found that the different housing bubble level exist in Beijing and Shanghai in the last 10 years. Beijing housing market has relatively serious bubble level in 2001, 2007, 2009 and 2010, and the bubble level values are respectively 4.45, 5.65, 6.53 and 10.98; Shanghai housing market has the relatively serious bubble level in 2009 and 2010, which are relatively 5.99 and 9.63. The housing bubble levels of both two cities reach the highest value in 2010, which shows a dangerous situation in the housing market of Beijing and Shanghai.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Beijing	4.45	0.82	-0.01	-0.13	0.81	1.15	5.65	1.16	6.53	10.98
Shanghai	-3.75	-1.92	-0.67	-0.12	-0.84	-0.14	0.16	1.64	5.99	9.63

Source: Beijing Statistics Yearbook(2011); Shanghai Statistics Yearbook(2011) (arranged by the study)
Fig.6. Level of the Real Estate Bubble of Beijing and Shanghai (2001~2010)

To compare the 10-year average bubble levels of Beijing and Shanghai, the study use formula (2) to explain the 10-year average bubble level.

$$\bar{B} = \sum_{t=1}^{10} B_t \Big/ 10 \tag{2}$$

Where

$\bar{B}$:   10-year average bubble level

B_i: Bubble level at year i

By calculation, the 10-year average bubble levels of Beijing and Shanghai are respectively 3.14 and 0.99, which shows that Beijing has a more serious bubble level than Shanghai in the last 10 years. There are many reasons for causing a housing bubble. The study mainly explores the correlation of housing speculation and bubble forming. Thus we will study on the housing speculation level in next section.

Measurement of Real Estate Speculation

According to Muellbauer and Murphy(1997) [27] , housing investors benefit mainly from two aspects. First, house owners benefit from property use, which is based on "zero capital yield"; the second aspect is the increase and decrease of capital gains caused by the house owner's expectation for price change.

The formula is:

$$P_t = P^m_t + H_t \tag{3}$$

Where

P_t: housing price in "t" period

P^m_t: housing price of "0" capital yield

H_t: income from property use

"H_t" is found to be relevant to "y" (income) and "I" (short-term interest rate); "H_t" symbolizes the present value of the expected capital yield.

Then

$$H_t = H^*_{t+1} \big/ (1+i_t) \tag{4}$$

Where

H^*_{t+1}: expected capital profits in the "t+1" phase

i_t: interest rate in the "t" phase

(3) and (4) shows that housing price is composed with the housing use value and the present value of the yield in lag phase. According to the positive feedback mechanism, H^*_{t+1} is likely to be relevant to the yield in the previous phase, namely, it is affected by "g_{t-1}" (price growth rate in the previous phase).
By research, Zhou(2004) [28] summarizes:

$$P_t = a_0 + a_1 Y_t + a_2 I_t + a_3 \left[(g_{t-1}) \big/ (1+i_t) \right]_t + \mu_t \tag{5}$$

Where

$a_0 + a_1 Y_t + a_2 I_t$: basic value of housing

$a_3 \left[(g_{t-1}) \big/ (1+i_t) \right]_t$: increased portion of housing price by speculation

P_t: housing price in t phase

Y_t: per-capita disposable income

I_t: lending rate

By calculation, it is found that the degree of real estate speculation is: $\theta=-a_3/a_2$. The larger the θ value is, the higher the speculation degree is, and the larger the probability of bubble forms. International experience shows that the safety value of θ is 0.4, in other words, if the degree of speculation exceeds 0.4, the real estate bubbles exist in housing market seem to be extremely sensible.

In order to examine the speculation degree of Beijing and Shanghai, the study collects relevant statistics data from 2001 to 2010 as shown in Table1. In empirical analysis, the dependent variable is *P:* average annual housing prices; the independent variables are respectively *Y:* Per-capita disposable income, *I*: lending rate, and $(g_{t-1})/(1+i_t)$: housing price growth rate.

Table.1 Relevant Data Used in the Measurement of Speculation Degree

Year	(P)Average annual housing price (Yuan/m^2)		(Y)Per-capita disposable income(PCDI) (Yuan)		(I)Lending rate		$(g_{t-1}/1+i_t)$Housing price growth rate	
	Beijing	*Shanghai*	*Beijing*	*Shanghai*	*Beijing*	*Shanghai*	*Beijing*	*Shanghai*
2001	*4716*	*3659*	*11578*	*12883*	*0.0585*		*0.0349*	*0.1001*
2002	*4467*	*4007*	*12463*	*13250*	*0.0531*		*-0.0528*	*0.0951*
2003	*4456*	*4989*	*13883*	*14867*	*0.0531*		*-0.0025*	*0.2451*
2004	*4747*	*6385*	*15638*	*16683*	*0.0558*		*0.0653*	*0.2798*
2005	*5853*	*6698*	*17653*	*18645*	*0.0558*		*0.2330*	*0.0490*
2006	*8276*	*8237*	*19978*	*20668*	*0.0572*		*0.4140*	*0.2298*
2007	*14420*	*10292*	*21989*	*23623*	*0.0693*		*0.7424*	*0.2495*
2008	*13222*	*14099*	*24725*	*26675*	*0.0634*		*-0.0831*	*0.3699*
2009	*15051*	*15404*	*26738*	*28838*	*0.0531*		*0.1383*	*0.0926*
2010	*22310*	*19168*	*29073*	*31838*	*0.0569*		*0.4823*	*0.2444*

Source: Beijing Statistics Yearbook (2011); Shanghai Statistics Yearbook (2011) (arranged by the study)

By linear regression analysis, the results are shown as (6) and (7)

$$(Beijing) \quad P_1=-10837.858+0.875Y_1+53463.422I_1+2788.153(g_{t-1})/(1+i_t)_1 + 10433.144 \qquad (6)$$

$$(0.871) \qquad (0.045) \qquad (0.122)$$

$$(Shanghai) \quad P_2=-2216.041+0.787Y_2-94325.85I_2+2927.937(g_{t-1})/(1+i_t)_2 + 3262.915 \qquad (7)$$

$$(0.996) \qquad (-0.92) \qquad (0.57)$$

The speculation degree of Beijing real estate market is: $\theta_1=-a_3/a_2=-2788.153/53463.422=-0.052$, as $\theta_1<\theta$ (0.4), the degree of speculation is less visible. In the above regression equation, *t* statistics is relatively large, so the dependent variables pass the significance testing; F statistics is 18.218, so the equation is possible; $R^2=0.901$, and then goodness of model fitting is high.

The speculation degree of Shanghai real estate market is: $\theta_2=-a_3/a_2= -2927.937/(-94325.85)= 0.031$, as $\theta_2<\theta(0.4)$, the degree of speculation is less visible. The *t* statistics is relatively large; F=123.376; $R^2=0.984$, thus it can be said that the dependent variables have passed the significance testing, and the equation is possible. Apparently, the speculation degree in Shanghai is more serious than that in Beijing, but both of them are not above the warning value (0.4). So it can be concluded that there are not high 10-year average degree of real estate speculation in both Beijing and Shanghai from 2001to 2010.
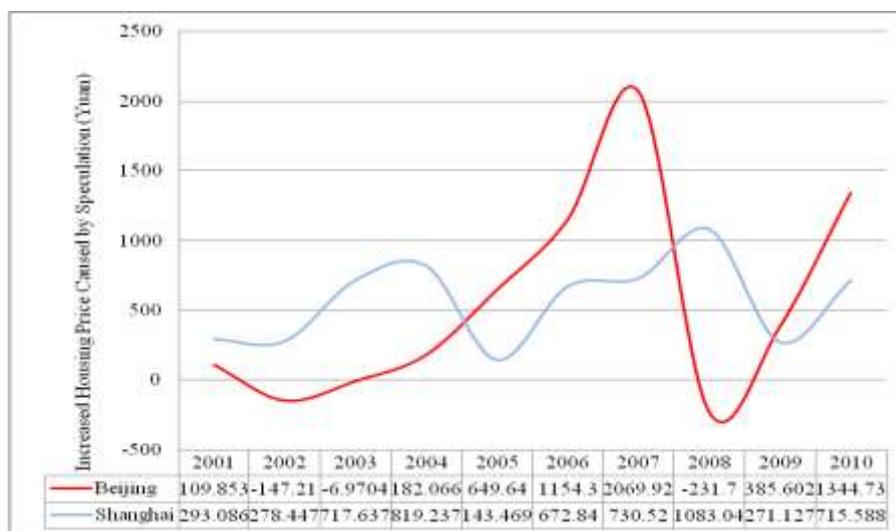
However, this indicator can only reflect the 10-year average peculation degree. In order to understand the degree of housing speculation every year accurately, the study will examine the increased parts of annual average housing price caused by speculation based on formula (5). The increased prices of the "speculation part" can be

defined as *"$a_3(g_{t-1})/(1+i_t)$"*. Therefore, the housing prices of the speculation parts of Beijing and Shanghai real estate markets are respectively:

$$S_{p1}=2788.153(g_{t-1})/(1+i_t) \tag{8}$$

$$S_{p2}=2927.937(g_{t-1})/(1+i_t) \tag{9}$$

By arranging statistics data, the situation of the housing prices increase caused by speculation is shown in Fig.7. In the situation of Beijing, it is found that the increased housing prices caused by speculation are minus value in 2002, 2003, and 2008; from 2000 to 2003, there is nearly no speculation that causes a increase of housing price in Beijing real estate market; from 2004 to 2007, whereas, the speculation gets to the top, which makes average housing price increase by 2069.92 (Yuan). In 2008, the speculation declines affected by the sub-prime crisis in the United States, many investors withdraw funds from real estate market to mitigate investing risks. However, good times do not last long, the "housing bubble price" increase again from 2009. From Shanghai's situation, some "bubble prices" exist from 2001 to 2010. The "bubble price" in 2008 is higher than that of Beijing probably because of the differences of investing expectation of investors.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Beijing	109.853	-147.21	-6.9704	182.066	649.64	1154.3	2069.92	-231.7	385.602	1344.73
Shanghai	293.086	278.447	717.637	819.237	143.469	672.84	730.52	1083.04	271.127	715.588

Source:Beijing Statistics Yearbook (2010); Shanghai Statistics Yearbook (2010)(rearranged by the study)
Fig.7. the Changing Situation of the Increased Housing Price Caused by Speculation (Yuan/m^2)

Additionally, the study also calculates the bubble price-to-housing price ratio so as to test the proportion of the bubble price caused by the speculation in total housing price. The test results are shown in Fig. 8. The bubble price-to-housing price ratio in Beijing reaches the highest value in 2007 and 14.4% of the housing price is caused by speculation. In 2002 and 2008, the lack of investment funds has led to the speculation atrophy in Beijing real estate market. Whereas, the proportion of bubble price in housing price begins to increase from 2009. In contrast, the indicators of Shanghai have been in a relatively high level, and the highest value is 14.4% in 2003 and the lowest value is 2.1% in 2005. Overall, the price bubble caused by speculation in Beijing and Shanghai account for respectively 5% and 7% of 10-year average housing prices.

By correlation analysis, it is found that the analysis results are not statistically significant. Therefore, in order to further explore the effects of the speculation on housing bubble forming in Beijing and Shanghai, the study integrate related data into the curve comparison chart as shown in Fig. 9. From this figure, it is obvious that the curve Fig.9 (a) has relatively more similar changing trend than Fig.9 (b), thus it can be concluded that Beijing has the stronger effect of the speculation on housing bubble forming than that of Shanghai.
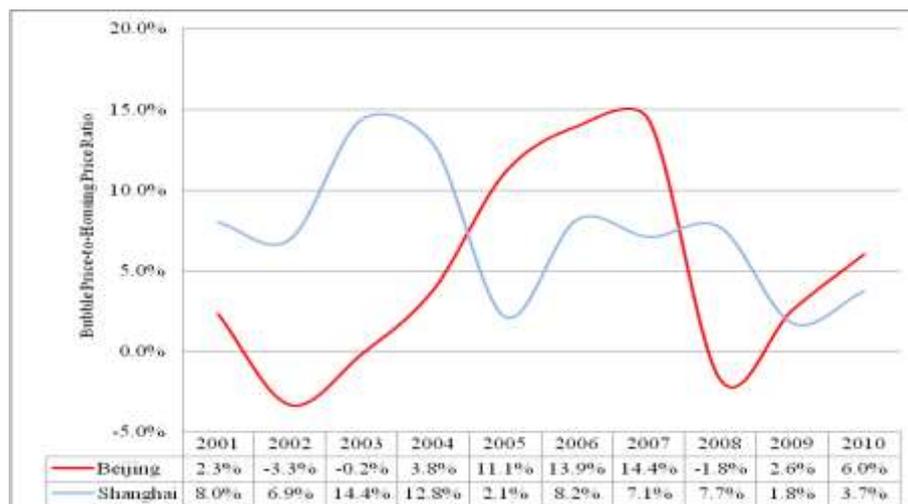
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Beijing	2.3%	-3.3%	-0.2%	3.8%	11.1%	13.9%	14.4%	-1.8%	2.6%	6.0%
Shanghai	8.0%	6.9%	14.4%	12.8%	2.1%	8.2%	7.1%	7.7%	1.8%	3.7%

Fig.8. Speculation price-to-Housing Price Ratio

(a) Beijing   *(b) Shanghai*

Fig.9. Comparison Chart of Speculation Degree and Bubble Level

CONCLUSIONS

This study respectively measured the degrees of real estate speculation and the degrees of real estate bubble in Beijing and Shanghai by index analysis and modelling method in order to analyse the effects of speculation on real estate bubble forming from 2001 to 2010, and the study found the following results.

Firstly, the 10-year average bubble degree of Beijing and Shanghai are respectively B1=3.14, B2=0.99, which shows that the degree of real estate bubble in Beijing is higher than that in Shanghai. Individually, Beijing has relatively serious bubble level respectively in 2001(4.45), 2007(5.65), 2009(6.53) and 2010(10.98); Shanghai housing market has the relatively serious bubble level in 2009 (5.99) and 2010 (9.63), showing an overall expansion tendency of real estate bubble and a dangerous situation in the real estate market of Beijing and Shanghai.

Secondly, the degree of real estate speculation in Beijing and Shanghai from 2001 to 2010 are respectively θ_1=-0.052, θ_2=0.031, the degree of real estate speculation in Shanghai is higher than that in Beijing, but they are thought to be not serious compared with the safety value 0.4. The bubble price-to-housing price ratio in Beijing reaches the highest value in 2007, which shows that 14.4% of the housing price is caused by speculation; the lack of investment funds has led to the speculation atrophy in Beijing real estate market in 2002 and 2008. The bubble price-to-housing price ratios in Shanghai have been in a relatively high level, and the highest value is 14.4% in 2003 and the lowest value is 2.1% in 2005; the bubble price caused by speculation in Beijing and Shanghai account for respectively 5% and 7% of annual average housing prices, which is basically consistent with the degree of real estate speculation in two cities.

Lastly, it is found that speculation is the important reason that causes a real estate bubble forming. Yet, the study has not found the regularity of correlation between speculation and bubble forming due to the insufficient data. However, by integrating related data into the curve comparison chart, the study found that Beijing has the stronger effect of the speculation on housing bubble forming than that of Shanghai.

In conclusion, Beijing and Shanghai are the first-tier developed cities in Mainland China. In the past decade, the real estate bubble is gradually formed while the real estate is rapidly developing, which makes their residents have increasingly heavier burden on home purchase. The speculation in real estate market is the main reason for high housing price, which can also play a role in the real estate bubble forming. Therefore, the study suggests that the government should make efforts to curb the real estate speculation through effective macro-control, property taxation, housing purchase limitation policy, and making housing assurance policy to make the equilibrium of supply and demand in real estate market, then the real estate bubble will not spread and return to a rational scope, and the urban economy will also have a healthy and stable development.

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