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PRICE-RENT RATIO IN CHINA'S HOUSING MARKET: PROPER INTERVAL, MEASUREMENT AND AN EMPIRICAL STUDY

Yuelay XIE and Hongyu LIU

Institute of Real Estate Studies, Tsinghua University, 100084 Beijing, China.
Fax: 8610-62788678, E-mail: xiee97@mails.tsinghua.edu.cn

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ABSTRACT. It has been a hot topic concerning about whether price bubbles exist in the housing market in several cities in China or otherwise. However, much of the debate lacks convincing evidence. This paper discusses the two factors which may lead the housing price to deviate from its fundamental value: rational bubble and economic irrationality. Also, the paper considers the price-rent ratio as a valid indicator in reflecting the rationality of the housing price. Based on an international comparative study and the Income Capitalization Method, this paper will show that the proper interval of the price-rent ratio in China's housing market should be around 150-200. At the end of this paper, an empirical study will be presented after an alternative measurement method for China's housing market is proposed. It will illustrate that housing prices in Shanghai and Hangzhou are overvalued while that in Beijing and Guangzhou are comparatively closer to the proper interval.

KEYWORDS: Price-rent Ratio; Price; Marketing Analysis; Housing Studies.

1. INTRODUCTION

Price-rent ratio refers to the ratio of the transaction price of housing (price for short) to the rental value of the house (rent for short)[1] . Housing prices and rents in a city or a region are affected by the relationship between supply and demand in the housing transaction market and housing leasing market, respectively. However, the two markets are highly correlated, as the demand in housing transaction market and that in housing leasing market are substitutes of each other (a household may either purchase or lease a house), and the supplies in the two markets may turn to each other (an owner may sell the house or rent it out). Generally, when the supply for housing in either market cannot meet the demand, both housing price and rent would inevitably rise, otherwise, both of them would fall. Thus, the price-rent ratio would usually be hovering within a proper interval[2] . Theoretically, the fundamental value of a house can be interpreted as the present value of all rental incomes generated in the future.

Yet that idealized situation stated above can be changed. Because of rational bubbles (Blan-

[1] This paper takes the monthly rent as the calculative criteria. Sometimes, the annual rent is also be used as denominator in calculating the price-rent ratio

[2] As the housing transaction cost is rather high, usually 10%-30% of the price (Nicola Financial Group, 2003), both the investors and the consumers are very prudent in their decisions of selling or buying a house. From the option theory and the transaction cost two aspects, Margaret Smith and Gray Smith has explained why there are not so many transactions in the housing market as in the stock market. In fact, in most cases, people sell their house because they have to. Evidently, a high transaction cost can weaken the mutual relationship between the housing price and the rent. At present, the transaction cost of the secondhand houses in China is mainly from the contract taxes and in some cities, income taxes have already been levied. But on the whole, the transaction cost in China is much less than that in the other countries.

chard & Watson, 1982) or consumers' economic irrationality, housing price may remarkably deviate from its fundamental value. It is harder to perceive speculative demand in the housing leasing market. That is to say, the rent in an equilibrium market is comparatively steady and can be considered as an actual reflection of the relationship between housing supply and housing demand. Therefore, price-rent ratio can be regarded as an indicator in measuring the price bubbles in the housing market (Tian Chuanhao, 2003) [3].

This paper firstly describes the intrinsic mechanism such as rational bubbles and economic irrationality, both of which influence the price-rent ratio. Then, based on an international comparative study and the Income Capitalization Method, this paper intends to find out the proper interval of price-rent ratio in China. Due to a significant structural difference between the housing transaction market and the housing leasing market in China, an alternative measurement method of price-rent ratio is proposed. Finally, the paper presents an empirical study on current price-rent ratio in Beijing, Shanghai, Guangzhou and Hangzhou.

2. MECHANISM OF HOUSING PRICE'S DEVIATION

2.1. Rational Bubble

In the real world, the housing price sometimes is unlikely to reflect its fundamental value. One of the key factors is people's expectation towards the impact of future housing price on current housing price. If it is expected that housing price will rise, an individual would like to purchase a house as soon as possible. As a result, the current purchasing demand will increase and thus lead to a rising housing price. In contrast, if it is expected that housing price is going to drop, they prefer to delay their purchase, and the current purchasing demand will decrease, which will likely result in a lower housing price. In other words, the change in housing price has a characteristic of self-fulfillment. Though the mortgage rate has hit a 40-year low, Krainer (2003) explained that the high expectation on capital gain was one of the more important factors in the surge of housing price in U.S. from 2000.

The Rational Bubble Model, which was put forward by Blanchard and Watson (1982), indicates that, even under the hypothesis of rational expectation, the asset prices may deviate from its fundamental value. In case people anticipate a continuous surge in asset price, as eventual capital gain would compensate the low current yield rate, the price would be pushed up further. Because of the rigid constraint on purchasing power, the positive change in housing price has its limitation. On the other hand, if people's expectation reverses, housing price bubbles may burst and housing price would decline rapidly.

The possible change of housing price from its fundamental value usually causes a deviation of price-rent ratio from its proper interval. In reverse, studies on price-rent ratio in a housing market help estimate the extent of price bubbles, and identify the risk of a particular investment. With the exception of studies on the current value of price-rent ratio, studies on the historical changes would be more helpful to estimate whether the market is bubbling or non-bubbling.

2.2. The Economic Irrationality

The Rational Bubble Model is based on the hypothesis of the rational economist. While in reality, there exist lots of irrational economic behaviors which may result in deviations of housing price from its fundamental value. It should be noteworthy that economic irrational-

[3] Actually, the rent might also be affected by speculative demand in housing transaction market. Once transaction price bubbles exist, the low yield rate might cause a decrease of supply in housing leasing market, resulting in a higher rent level. As some of the effects of the price bubbles might be overlapped by the rental increases, piece-rent ratio seems to underrate the price bubbles in general.

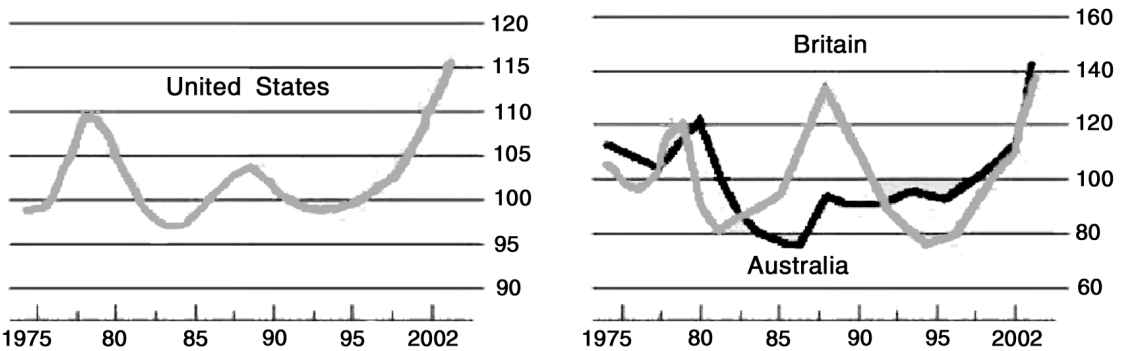
ity is irrational, only when it is viewed from the perspective of economic benefit. But it does not mean that the behaviors themselves are irrational, as socio-psychological factors in a sense influence human behaviors. These factors include sensibility of a safe and stable life, habitual way of thinking, "face-saving", psychology of following suit and recessive cost of transactions. For example, it has always been the case that Chinese people have the mentality of possessing their own houses and they care much for that. So far, at least, the idea, that renting a house is good way of meeting the housing need, is not that widely received. Another example is that the younger generations believe that purchasing a house is one of the conditions to get the premise of marriage. However, once owning their houses, even if the rent is fairly low while the house price is rather high, they may still be unwilling to sell their house and rent another. Thus, the habitual consuming behaviors and the recessive cost of transaction both will possibly change the mutually replaceable character of the alternatives of leasing or purchasing a house, thus changing an individual's preferences in the process.

In brief, between the alternatives of renting a house or purchasing one, there exists a "conservative tendency" to the latter although it is not that feasible of evaluating quantitatively how the "conservative tendency" influences the price–rent ratio. Nevertheless, taken into consideration of the prevalent mentality of owning a house, it is hard for economic irrationality to cause sustainable wide-range deviations from the fundamental value. Logically, "conservative tendency" is unlikely to bring a striking disparity of the price-rent ratio into the likes of Beijing, Shanghai, Guangzhou and Hangzhou. As a result, this paper attempts to explore whether the housing price is reasonable or not, by investigating the price-rent ratio in the four cities mentioned above.

3. THE PROPER INTERVAL OF THE PRICE-RENT RATIO

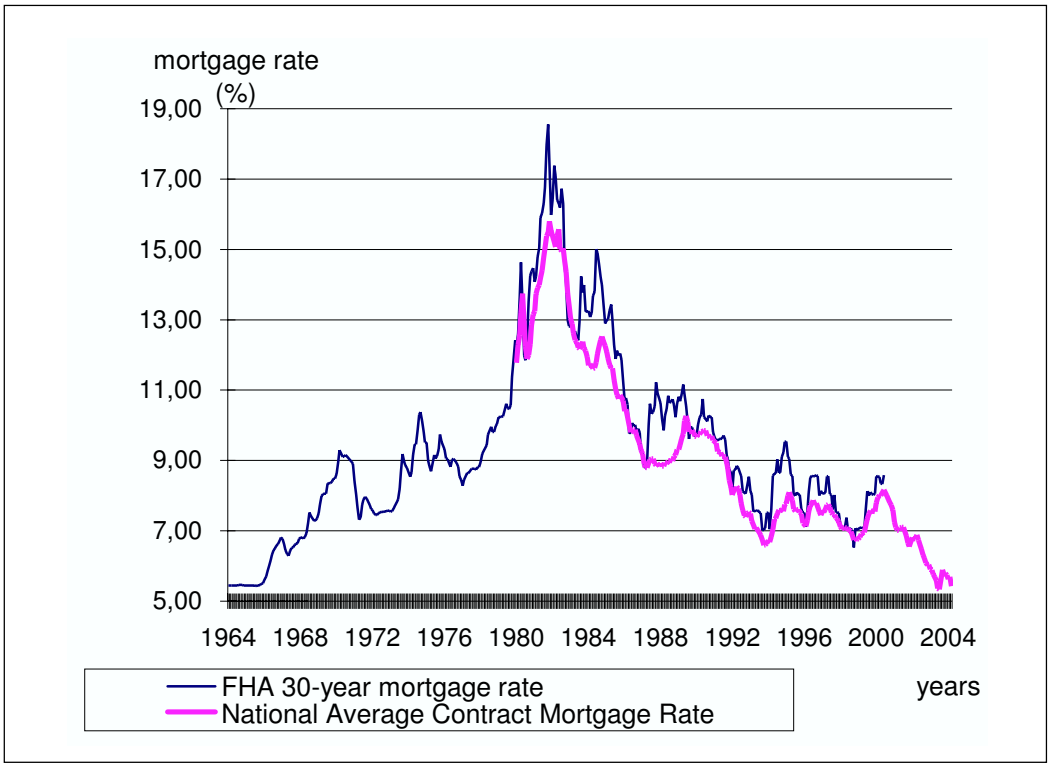
3.1. An International Comparative Study

Figure 1 illustrates the time series of the price-rent ratio in the U.S., Britain and Australia from 1975 to 2002. Nicola Financial Group (2003) suggests that in these years the mean price-rent ratio has been moving around 100 (i.e., with a yield rate at 12% per year). It is clear that, in the U.S., the yield rate in the residential market has stabilized at 11%-12% for quite some time. Then, it began to decrease after year 2000. Comparatively speaking, the



Source: Nicola Financial Group (2003)

Figure 1. Price-rent ratio in America, Britain and Australia from 1975 to 2002



Source: Economagic.com & FHFB

Figure 2. Changes in mortgage rate in America from 1964 to 2004

price-rent ratio in Britain and that in Australia was not that stable, fluctuating between 80 and 140. The respective yield rates have been ranging from 8.5% to 16%.

The time series of the price-rent ratio reflects the movement of the housing price. As shown in Figure 1, in the late 1970s and late 1980s, the price-rent ratio in America reached its peak which was consistent with the movement of the housing price. But, noticeable drops were observed in the mid 1980s and in year 1993. Then, since 2000, the housing price in America has rapidly ascended and the price-rent ratio accordingly has set a new record, courtesy of the 40-year low interest rate along with other factors. Similar price-rent ratio movements are found in Australia and Britain.

Actually, time series of price-rent ratio in large countries only shows slight fluctuations, as housing price bubbles do not likely appear in the whole country at the same time, with the same level of impact on prices[4]. However, if it is focused on more prosperous cities (compared with its surrounding cities and regions), it can be observed that the fluctuation of the housing price and that of the price-rent ratio will be remarkably striking, because there would be more speculative investment in those cities. Thus, one can easily judge through the price-rent ratio, whether the housing price is reasonable or not.

Comparing Figure 1 with Figure 2, it should be noted that the fluctuation of the price-rent ratio is very much related to the changes in interest rate. Besides, a change in the former

[4] Actually, B. M. Roehner (2003) shows clearly the housing bubbles are likely to appear earlier and in a much larger scale in those cities with higher housing prices.

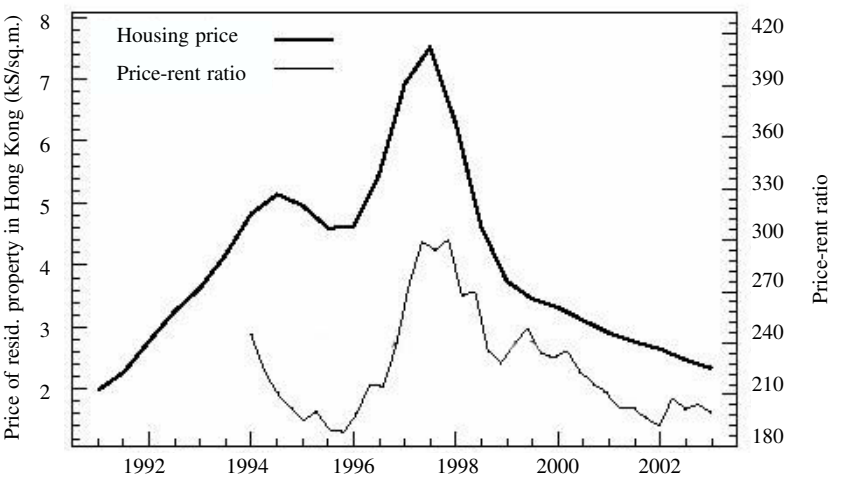
likely follows a change in later, which means that the interest rate can greatly affect the price-rent ratio. For example, a rise in interest rate could well account for a drop in the price-rent ratio after 1978; during the period of 1980-1985, the interest rate was very high while the price-rent ratio maintained at a relatively low level; and after 1985, a rising price-rent ratio was always accompanied by falling interest rate. In hindsight, there is a negative relationship between interest rate and price-rent ratio.

The observation above indicates that in a macro-market like the U.S., a change in the interest rate can lead to a moderate change in the price-rent ratio. Meanwhile, in local housing market, speculative demand might be a more important factor affecting the change of the housing price, thus the price-rent ratio.

Figure 3 shows the time series of the price-rent ratio in the residential property market in Hong Kong. It is clear that the price-rent ratio is in accordance with the housing price, as the rent is much more stable than the housing price. In the three years before 1997, the average rent in the housing market had maintained at around $300 per square meter per year. In October 1997, housing price in Hong Kong's residential market reached its peak. Since then, housing price has dropped to a third of its all-time highest level, but rent has only dropped by roughly 50% from that in 1997.

Compared with the historical data in the U.S., Australia and Great Britain, the current price-rent ratio in Hong Kong is relatively high (around 190). Does it mean that price bubbles still exist in the housing market in Hong Kong?—not necessary. Certainly, the interest rate—the important factor influencing the price-rent ratio, is quite low now and if it rises in the future, the price-rent ratio in Hong Kong's housing market is likely to keep decreasing. However, the price-rent ratio is much higher in prosperous cities with remarkable development potential. For instance, in 1995 when the housing price was in its trough, still, the price-rent ratios in Orange County (California), New York, Boston, and San Francisco were within 200 to 250. Thus, it is clear that this phenomenon has much to do with investors' preference in purchasing properties in those cities with investment potential. Admittedly, Hong Kong is a rather prosperous city. Therefore, investors would like to invest in residential properties here, which might lead to a much higher price-rent ratio.

Nicola Financial Group (2003) summarized that the economic value of houses can be re-



Source: Bertrand M Roehner (2003).

Figure 3. Price-rent ratio in Hong Kong's housing market

garded as a function of rent, mortgage rate and location. Similarly, we can get the idea that a rational price-rent ratio can also be considered as a function of mortgage rate and location. In fact, mortgage rate affects consumers' purchasing power and investors' financing cost; and location covers the development potential of a city, its attraction for investment and the characteristics of local consumers' behaviors, etc. For quite a long time people have been under the impression that the rational price-rent ratio should be about 100—a macro scope statistics under the condition of a high interest rate. But actually, a rather reasonable price-rent ratio should be higher than 100 because in some newly-developing cities, the price-rent ratio is relatively higher and a lower interest rate can cause a higher price-rent ratio. Take San Francisco as an example, the price-rent ratio in 1995 was 250, which was almost the highest among the major metropolitans in America. Thus, the upper limit for a rational price-rent ratio should be 250.

3.2. Income Capitalization Method

Investment in housing usually refers to the possession of a house with the right to rent it out and by doing so, getting a periodic return ("real leasing" for short). From the view of housing price appreciation, developers in China often insist that housing is a kind of investment asset. However, for those buying a house for self-use only, the gain from housing price appreciation is hard to be realized despite the possible wealth effect. Still people often believe that purchasing a house is an investment. Theoretically speaking, a household may either purchase or lease a house. The choice on purchasing or leasing indicates whether the return of purchasing a house meets an individual's expectations. If people feel that the rent is relatively cheap while the housing price cannot guarantee a return, they would like to rent houses; otherwise, they would prefer to purchase houses.

If housing price is equal to its fundamental value at the time, we can get the following hypothesizes.

Hypothesis 1: If a house is never resold after purchase, its price should be the NPV of all future rental incomes[5].

Hypothesis 2: If a house is to be sold after being held for a period, its price should be the NPV of the rental income during its being held period plus the NPV of sale price in the future.

Suppose the sale price in the future equals to its fundamental value of the time, then, hypothesis 1 and hypothesis 2 are coincident with each other. We take hypothesis 1 as a computational model. Assume that the rent would be a constant, because of

$$\mathrm{P} = \frac{r}{i},$$

Then, the proper price-rent ratio should be

$$\frac{P}{r} = \frac{1}{i}.$$

That is to say, the proper price-rent ratio is equal to the reciprocal of yield rate. Yield rate is, determined by macro-economic factors, and correlated with the risk of housing market in a city or a region. Obviously, price-rent ratio in different cities or regions might be different, but the differences between the metropolitans in China would not be extraordinarily prominent.

Suppose the rent appreciation rate is g ($g < i$), because of

$$\mathrm{P} = \frac{r}{i-g},$$

Then, the proper price-rent ratio should be

$$\frac{P}{r} = \frac{1}{i-g}.$$

The appreciation rate is different in various cities or regions. Thus the following deduction would be obtained.

[5] The lifecycle of houses is quite long. This paper ignores the limitation of life-span and the residue value in calculation of fundamental value of houses.

Deduction 1: For those cities or districts under development or with development potential, the price-rent ratio should be a little higher.

Today, in China, as most housing purchases being supported by mortgage loans, the return rate of purchasing a house should not be lower than the mortgage rate (5.04%). Otherwise, a negative financial leverage would lick up the profit margin, inducing a loss. This paper takes the mortgage rate as the basic rate in calculating the discount rate[6]. On the other hand, risk premium, which is the difference between return rate and basic rate, should be consistent with the risk of housing market. If the risk premium is too high, purchases in housing market via mortgage loans, both for self-use only and for investment, would increase, thus the rent would decrease, and the price might rise slightly. Theoretically, yield rate ($y = \frac{r}{P}$), basic rate (i_0), risk premium (i_{risk}), and rent appreciation rate (g) should be abided by the following equation:

$$\frac{r}{P} = i_0 + i_{risk} - g$$

The equation above includes four stochastic time series. However, it is rather difficult to ascertain a rational value for each variable in a certain period. Therefore, we try to find out empirically the relationship between the yield rate and the basic rate from past data (Table 1).

In the last 30 years, the value of $y - i_0$ has been about -3.0% to 4.7% in U.S. Actually, the negative number in 1981 was due to a high interest rate under the influence of a high level of inflation. Meanwhile in the 1990s, the mounting of $y - i_0$ was probably affected by the low rent appreciation rate[7]. With an appropriate interest rate and a moderate rent appreciation rate, the proper value of $y - i_0$ should be ranging from 1% to 3%. Based on this, the following deduction can be reached.

Deduction 2: Mortgage rate can be considered as a basic rate. Considering a 1%~3% gap between the yield rate and the basic rate, the proper interval of price-rent ratio in today's urban China should be around 150~200.

4. ALTERNATIVE MEASUREMENT OF PRICE-RENT RATIO

In many developed countries, there are both a prosperous housing leasing market and a mature housing transaction market. For the latter, secondhand housing plays the dominant

Table 1. Yield rates and mortgage rates in U.S. from 1975 (price-rent ratio at low level)

Time	Early 1975	Early 1976	Middle 1981	Early 1984	Early 1986	Early 1991	Early 1993	Early 1996
Price-rent ratio	99	100	100	97	100	100	98	100
Yield rate	12.1%	12.0%	12.0%	12.4%	12.0%	12.0%	12.2%	12.0%
Mortgage rate	9%	9%	15%	12%	10.5%	9.5%	7.5%	7.5%
$y - i_0$	3.1%	3.0%	-3.0%	0.4%	1.5%	2.5%	4.7%	4.5%

[6] Noguchi Yukio (1992) also takes the mortgage rate as the basic rate in his research on the land price bubbles in Japan.

[7] The rent appreciation rate in 1990s in U.S. is around 4%, i.e., about 2~3% lower than that in late 1980s (Krainer, 2003).

role. Between these two housing markets, no significant structural difference exists. Thus, it is quite reasonable to use the mean price in the transaction market and the mean rent in the leasing market to calculate the price-rent ratio. However, this is not the case in China. Theoretically, the data of housing price and rent in measuring the price-rent ratio should come from homogeneous residences. Therefore, this paper proposes an alternative method, comprising the following three principles in the measurement of price-rent ratio in China£º

(1) Principle of Site Sampling. Site sampling means that data collection of price and rent should be limited to neighborhoods. The price-rent ratio on one site just indicates the market situations around it, so that sufficient sites should be selected to combine single-site analyses and multi-sites comparative studies in investigating a city or a region.

(2) Principle of Unit Price. The ideal situation is to calculate the price-rent ratio according to the current selling price and the rent of the same house. However, such statistics is beyond our reach, and even if it exists, the volatility included in price and rent of a single house also has impacts on the accuracy of the price-rent ratio. Thus, we need to integrate the prices and rents of several sets of houses, and the problem of how to average it springs up. In our opinion, the mean price (or mean rent) should not be the average of gross prices (or gross rents), instead it should be the average unit price (or unit rent). By doing so, the differences in housing space could be discounted.

(3) Principle of Homogeneous Properties. There are many differences among houses, such as architecture style, constructing time, circumjacent environments, virescence, property management, etc. For example, concerning architecture style, houses can be categorized as bungalows, multilayer apartment, high-rise apartment, and so on. Obviously, when attempting to integrate prices and rents of several sets of houses, it is necessary to ensure that those houses are homogeneous. Thus, it is better to sample in the same "Xiaoqu", which in China is a community that consists of several homogeneous residential buildings, developed and managed by the same developer. Transaction cases and lease cases collected in one site should be diversified in terms of housing space, exposed direction, floor, etc. This kind of diversifications helps minimize the measurement errors by balancing out the good and the bad. Besides, the distribution of transaction cases and that of lease cases on each factor should be similar.

5. AN EMPIRICAL STUDY ON FOUR CITIES IN CHINA

5.1. Data collection

Beijing, Guangzhou, Shanghai and Hangzhou are the four most developed cities which have a GDP per capita of over 3000 dollars and a mature housing market. In recent years, housing price in Beijing has been condemned of being too high, and there are debates on the rapidly rising housing price in Shanghai and Hangzhou as well.

To calculate the price-rent ratio in the four cities, 46, 9, 21, 27 sites are selected respectively. The data of Guangzhou is from the C2C secondhand houses transaction platform on the website of Sina.com. Others are from www.5i5j.com. We distribute the sites to be consistent with the distribution of the respective current housing supply in the cities, and then follow the principles described above on sites sampling and cases collection. Although the data is about the bid price (or rent), a warp is acceptable. The quotation of the transaction cases is within the period from September 18, 2003 to March 17, 2004; while that of the leasing cases is from December 18, 2003 to March 17, 2004[8].

5.2. Data

A survey of price-rent ratio in four cities in China is summarized in Table 2.

The average price of homogeneous residences can be taken as one of the categorizing standards. This paper classifies the residential properties into three categories: the high market (price above 8000RMB per square meter), the moderate market (price above 5000RMB per square meter and below 7999RMB per square meter), and the low market (price below 4999RMB per square meter). Then, we can see a remarkable result, as shown in Table 3.

Table 4 and Table 5 reveal the differences of price-rent ratio in various districts in Beijing and Hangzhou respectively.

More detailed information about price-rent ratios on each site is listed in the appendix.

Table 2. General view of price-rent ratios in four cities in China

City	Number of sites	The Lowest price-rent ratio	The Highest price-rent ratio	The highest/ the lowest	The Mean price-rent ratio
Beijing	46	118	269	2.28	177
Guangzhou	9	160	243	1.52	194
Shanghai	21	169	359	2.12	261
Hangzhou	27	151	780(428)	5.16(2.83)	332(286)

Note: The numbers in parentheses exclude three remote sites whose price-rent ratios are extremely high.

Table 3. Price-rent ratios in some segmental markets

Category	Beijing		Hangzhou		Shanghai	
	Number of sites	Mean price-rent ratio	Number of sites	Mean price-rent ratio	Number of sites	Mean price-rent ratio
High market	16	**164**	6	**260**	4	**188**
Moderate market	22	**176**	18*	**295***	17	**278**
Low market	8	**203**	NA	NA	NA	NA

Note: * The data also exclude three remote sites whose price-rent ratios are extremely high.

Table 4. Price-rent ratios in various Districts in Beijing

District	Chaoyang	East City	Haidian	Fengtai	Shijingshan	Others	Total
Number of sites	12	5	13	8	4	4	46
Mean price-rent ratio	152	163	175	195	222	NA	177

Table 5. Price-rent ratio in various Districts in Hangzhou

District	Xiacheng	Shangcheng	Xihu	Jianggang	Gongshu	Binjiang	Total
Number of sites	4	4	9	6	3	1	27
Mean price-rent ratio	236	298	304	363	379	780	332

[8] Data collection was completed in two batches. Supplementary sites were selected to promote the accuracy of measurement. However, the stability of price-rent ratio in each city is quite good. For example, price-rent ratio in Shanghai was 271 and 261 when 7 sites and 21 sites were selected respectively.

5.3. Analysis

Through the study above on price-rent ratios in four cities in China, the findings are as follows:

1. As a whole, the price-rent ratios in Beijing and Guangzhou are in the proper interval, while those in Shanghai and Hangzhou are notably higher than rational level[9].
2. Price-rent ratio in the outskirts of a city or other developing regions is proved to be more or less higher.
3. Price-rent ratios are different in various sites within a city. This indicates that a part of the housing market might be at non-equilibrium[10], and the regional structure of leasing demand might be different from that of the purchasing demand[11]. When price-rent ratio on various sites of a city is studied, a regional distinction of housing market might also be revealed. Therefore, sites selected should be sufficient in quantity and representative of the properties in the local area.
4. In the same community with homogeneous residential buildings, the unit rent of a larger house is relatively lower than that of a smaller house. However, the variation in housing price is not as large as that of the rent. Therefore, smaller houses usually can have a better return rate of investment[12].
5. The price-rent ratio in high market seems to be relatively lower, which means the return rate of investment in high market is much better.
6. The price-rent ratio is lower, once an area in a city is more developed, and the return rate of the investment will be higher[13].

6. CONCLUSION

From the aspects of rational bubbles caused by speculative activities in the housing market and consumers' economic irrationality, this paper has explained why the housing price often deviates from its fundamental value, and also has put forward an idea that the price-rent ratio is an indicator for such deviations. Evidently, from the historical data about the price-rent ratio in some other countries, it can be assumed that a rational price-rent ratio can be affected by the mortgage rate, the development potential of a city and its attraction for investment. Actually, development potential and attraction for investment can result in potentially higher rents or relatively less risk in investment. Besides, the study also indicates that the rational price-rent ratio in the major cities in China should be around 150-200. At present, the interest rate is rather low. Recently, there have been discussions about

[9] The price-rent ratios in Shanghai and Hangzhou are quite close to the level in H.K. in 1997.

[10] Theoretically, as investors would like to purchase houses with a low price-rent ratio to maximize their profit, both the purchasing demand and the leasing supply of such houses increases and this would cause the price-rent ratio rise. In another word, demand from investors helps to eliminate the existence of price-rent ratio lower than market. However, information asymmetry, insufficiency of demand from investors or insufficiency of marketable supply may weaken the neutralization effectiveness. On the other hand, many owners who holding more than one houses prefer to rent out redundant houses rather than sell them even if the price-rent ratio is quite high, unless they really need to liquidize them. Thus, high price-rent ratio could exist in some areas in a city.

[11] For example, in those areas with a high density of short-term tenant such as regions around the universities, the rent is likely to be relatively high, that is to say, the price-rent ratio is relatively lower.

[12] This finding was observed mainly in moderate and low market, and might be correlative with the character and segmentation of the leasing demand. Most tenants in moderate and low market are singles, young couples without children, or new employees just starting their careers. All of them are unnecessary and unwilling to rent a big house.

[13] It seems to be a paradox that price-rent ratio in prosperous cities would be higher while that in more developed areas in a city would be comparatively lower. However, the latter finding might be ascribed to a quite different mechanism, such as the non-elastic housing supply in more developed areas in a city.

whether the interest rate should be elevated to some degree to cool down the over-heated economy. Therefore, for the investors, the risk of the interest rate movements in the future deserves more attention.

If we take 200 as the benchmark for the proper price-rent ratio, then, price bubbles in Hangzhou and Shanghai account for about a quarter of the current housing price. This conclusion confirms the popular view that housing price in these two cities has deviated from its fundamental value. Nowadays, it seems that speculative capital begins to withdraw from the two cities. As the expectation of housing price changes, the housing price in Hangzhou and Shanghai would tail off and reverse in the next three to five years. The price-rent ratios in Beijing and Guangzhou are quite reasonable and there are no price bubbles in their housing markets.

This paper indicates that measuring the price-rent ratio in a housing market can effectively reveal its current situation, especially the proportion of price bubbles in the market. Furthermore, based on the measurement of price-rent ratio, a combination of single-site analysis, multi-site comparison, and comparative studies on various segmental markets or various regional markets can reveal the internal structure and heterogeneity of the housing market.

REFERENCES

Blanchard, O. J. and Watson, M. W. (1981) Bubbles, Rational Expectations and Financial Markets [M], *Crises in the Economic and Financial Structure*, edit by Paul Watchtel, Lexington Bovks, New York.

Cao, Z. L. and Fu, S. H. Real Estate Bubbles and Its Prevention [J]. C*hina Real Estate*, 2000(2), pp. 7–11;

Fu, S. H. Land Speculation and Land Price Bubbles [J]. *China Land Science*, 1999(2), pp. 22–25;

Krainer, J. (2003) House Price Bubbles, *FRBSF economic letter*, *http://www.frbsf.org/publications/economics/letter/2003/el2003-06.pdf*

Nicola Financial Group. (2003) Castles in the Sky - Is Real Estate the Next Bubble? *http://www.nicola-financial.com/r_newsletters.asp*

Roehner, B. M. (2000) Speculative Trading: the Price Multiplier Effect [J]. *The European Physical Journal* B 14, p. 395–399.

Roehner, B. M. (2003) Patterns of Speculation in Real Estate and Stocks, *Proceedings of the Nikkei Workshop in Econophysics* (Tokyo, November 2002). Springer-Verlag. Berling.

Smith, M. H. and Smith, G. (2004) The Valuation of Houses in an Uncertain World with Substantial Transaction Costs. Working Paper. *http://www.economics.pomona.edu/GarySmith/WhenBuyHouse/WhenBuyHouse.html*

Tian, C. H. (2003) Review on Current Researches on Real Estate Bubbles [J], *Zhejiang Economy*.

APPENDIX: LISTS OF SITES

Table A1. List of Sites in Beijing

District	Site (name of home coomunity)	Number of sellcases	The mean price (RMB per square meter)	Number of lease cases	The mean rent (RMB per square meter)	Price-rent ratio
Chaoyang	Xiandaicheng	10	11798.32	21	73.67	160.14
Chaoyang	Tuanjiegongyu	3	8807.53	12	62.88	140.06
Chaoyang	Houxiandaicheng	4	7225.52	9	52.19	138.45
Chaoyang	Jiaheliyuan	2	13700.00	13	88.42	154.93
Chaoyang	Yangguang100	5	10737.29	52	71.90	149.34
Chaoyang	Fenghuangcheng	10	9734.13	24	67.19	144.88
Chaoyang	Huatengyuan	21	6667.10	235	45.06	147.96
Chaoyang	Fangzhouyuan	15	5856.46	51	36.69	159.61
Chaoyang	Wangjingxiyuan*	4	4360.69	5	26.93	161.94
Chaoyang	Wangjingxiyuan**	11	5518.61	22	35.53	155.32
Chaoyang	Wangjingxincheng	31	5127.64	103	36.36	141.02
Chaoyang	Nanhudongyuan	11	4750.32	18	27.28	174.12
Chongwen	Jingyuchi	6	5606.71	13	26.27	213.42
Dongcheng	Dongfangyinzuo	8	16104.05	79	103.48	155.63
Dongcheng	Yangguangdushi	7	11449.35	15	65.39	175.10
Dongcheng	Haishengmingyuan	5	11226.23	22	87.09	128.90
Dongcheng	Yonghejiayuan	4	9955.91	30	62.94	158.17
Dongcheng	Min'anxiaoqu	8	7120.86	44	35.83	198.76
Fengtai	Shiliuyuan	8	4476.66	12	21.53	207.94
Fengtai	Fangqungongyu	8	6677.78	39	39.20	170.35
Fengtai	Pengrunjiayuan	8	6604.18	34	42.11	156.83
Fengtai	Kaiyanglixiaoqu	4	5864.17	7	21.89	267.95
Fengtai	Lianhuaxiaoqu	3	5718.61	13	36.85	155.17
Fengtai	Fangchengyuan	12	5485.41	41	29.72	184.58
Fengtai	Yihaihuayuan**	8	5460.85	24	31.36	174.15
Fengtai	Yihaihuayuan*	4	5434.37	9	22.64	240.03
Haidian	Meilinhuayuan	6	9130.55	8	57.94	157.59
Haidian	Taiyueyuan	19	7181.51	13	43.95	163.42
Haidian	Shijicheng	24	6853.71	19	45.36	151.09
Haidian	Feichangsushe	5	6561.73	7	55.56	118.11
Haidian	Shididongli	7	5484.58	7	29.47	186.10
Haidian	Yongtaidongli	3	4286.07	7	21.77	196.91
Haidian	Renjishanzhuang	7	11017.51	43	52.66	209.20
Haidian	Guoxingjiayuan	6	9397.75	12	61.38	153.11
Haidian	Zhonghaiyayuan	6	8121.66	37	49.51	164.03
Haidian	Jindianhuayuan	11	8027.27	106	51.63	155.48
Haidian	Tianxiuhuayuan	5	6497.22	5	29.62	219.35

Haidian	Daoxiangyuan*	3	6267.63	16	35.85	174.81
Haidian	Daoxiangyuan**	2	6239.97	12	28.13	221.81
Shijingshan	Yonglexiaoqu*	8	4409.64	8	19.25	229.04
Shijingshan	Yonglexiaoqu**	6	4214.39	4	20.94	201.27
Shijingshan	Haitehuayuan*	4	3737.88	6	14.82	252.22
Shijingshan	Haitehuayuan**	7	3698.27	5	18.08	204.51
Xicheng	Taoyuanxiaoqu	4	8458.76	24	31.45	268.93
Xicheng	Jiadajiayuan	4	8310.54	9	54.58	152.27
Xuanwu	Qingzhiyuan	4	6933.14	14	50.13	138.31

Notes: * Multilayer apartment;
** High-rise apartment.

Table A2. List of Sites in Hangzhou

District	Site (name of home coomunity)	Number of sellcases	The mean price (RMB per square meter)	Number of lease cases	The mean rent (RMB per square meter)	Price-rent ratio
Shangcheng	Haiyuhuayuan	3	6717.43	6	31.33	214.44
Shangcheng	Huanshalu	3	7478.71	2	26.95	277.52
Shangcheng	Guangfulu	3	6802.54	5	23.70	287.02
Shangcheng	Hanlinhuayuan	3	9397.61	6	22.69	414.10
Shangcheng	Jiahuidasha	6	8175.63	12	40.36	202.55
Shangcheng	Zhongshanbeilu	4	6180.07	11	26.46	233.57
Shangcheng	Wulinlu	5	7402.92	10	31.63	234.03
Shangcheng	Deshengdongcun	8	5946.50	16	21.61	275.19
Xihu	Nanduyinzuo	7	8531.25	9	56.42	151.20
Xihu	Nandudejia	10	8394.22	7	41.79	200.89
Xihu	Cuiyuan'erqu	3	5859.22	6	24.36	240.52
Xihu	Kanglexincun	5	5796.57	9	23.41	247.62
Xihu	Hupanhuayuan	5	8127.30	7	28.81	282.13
Xihu	Huanglongyayuan	5	12334.75	4	40.17	307.06
Xihu	Wencuiyuan	2	7398.25	21	23.44	315.68
Xihu	Xianggangcheng	4	6559.61	5	20.47	320.49
Xihu	Wenzhoucun	3	7736.48	6	11.59	667.66
Jianggan	Guangyindasha	6	7414.21	9	45.46	163.10
Jianggan	Zhanongkouxincun	2	6002.09	6	19.95	300.78
Jianggan	Jingfangliuqu	3	7669.15	3	23.20	330.51
Jianggan	Jingyinhuayuan	10	7274.57	4	21.02	346.14
Jianggan	Sanlixincheng	2	6740.74	3	17.13	393.54
Jianggan	Jingjiangbandao	6	5215.05	3	8.07	646.07
Gongshu	Hemuxincun	4	5495.33	6	17.25	318.65
Gongshu	Mingchengzuoan*	4	5368.33	7	13.72	391.26
Gongshu	Mingchengzuoan**	7	6028.56	9	14.09	427.81
Binjiang	Jiangbinhuayuan	7	6644.57	8	8.52	780.01

Notes: * Multilayer apartment;
** High-rise apartment.

Table A3. List of Sites in Shanghai

District	Site (name of home coomunity)	Number of sellcases	The mean price (RMB per square meter)	Number of lease cases	The mean rent (RMB per square meter)	Price-rent ratio
Minhang	Hanghuaercun	13	5320.64	1	24.19	219.92
Minhang	Mingduxincheng	5	7069.33	4	20.97	337.19
Changning	Haifugongyu	2	8286.83	1	46.67	177.57
Changning	Xianxiadajun	2	7522.73	3	36.29	207.31
Changning	Xintingxincheng	9	6419.11	8	27.46	233.74
Putuo	Jinfangxiaoqu**	2	7373.74	3	30.89	238.70
Putuo	Jinfangxiaoqu*	3	6790.44	3	30.23	224.64
Zhabei	Haiyugongyu***	1	9929.08	1	46.10	215.38
Zhabei	Pushanxinyuan	1	6152.34	2	18.17	338.69
Hongkou	Hengshengbandao	3	16003.53	3	84.20	190.06
Jing'an	Lanchaobuluo	7	11842.52	7	70.00	169.18
Xuhui	Changqiaoxincun	11	6368.48	7	20.48	310.94
Xuhui	Meilongxincun*	27	5969.01	31	23.12	258.12
Xuhui	Meilongxincun**	9	5946.76	3	18.81	316.10
Xuhui	Tianlinxincun	5	7706.51	5	31.68	243.23
Yangpu	Anshanxincun	1	7027.41	2	24.64	285.24
Yangpu	Shiguangxincun	9	6162.02	1	19.05	323.51
Pudongxinqu	Shangnanercun	4	6388.51	6	21.99	290.48
Pudongxinqu	Lianxixincun	7	5833.46	6	18.36	317.69
Pudongxinqu	Xinlingdi	3	7502.36	3	34.72	216.10
Pudongxinqu	Jiaonanxiaoqu	2	6395.88	2	17.84	358.55

Notes: * Multilayer apartment;
** High-rise apartment.
*** In the site of Yuhai Flat, both the selling quotation and the renting quotation are from the same suit.

Table A4. List of Sites in Guangzhou

District	Site (name of home coomunity)	Number of sellcases	The mean price (RMB per square meter)	Number of lease cases	The mean rent (RMB per square meter)	Price-rent ratio
Panyu	Lijianghuayuan	4	3070.90	7	12.64	243.02
Haizhu	Xiaogangwan	4	3457.09	1	14.58	237.06
Haizhu	Jinbihuayuan	5	3585.65	5	22.39	160.13
Tianhe	Zhonghaikang-cheng	3	4290.99	2	19.83	216.43
Tianhe	Jianadahuayuan	7	3418.35	15	19.67	173.82
Tianhe	Meihaoju	2	3513.62	3	20.28	173.29
Tianhe	Huaganghuayuan	7	4269.36	6	25.24	169.14
Dongshan	Wuyangxincheng	7	3857.28	14	20.50	188.20
Liwan	Fuliguangchang	2	5302.70	2	28.32	187.22