House Price Bubbles in China*

Yu Ren Yufei Yuan† Cong Xiong

The Wang Yanan Institute for Studies in Economics

Xiamen University, Fujian, China, 361005

October 10, 2010

*Yufei Yuan is an Assistant Professor at Xiamen University. Yuan's research was supported, in part, by Xiamen University. Yu Ren is an Assistant Professor at Xiamen University. Ren's research was supported by Xiamen University and National Science Foundation of China grant #70971113. We thank the seminar participants in the annual meeting of China Economics Society 2010.

†Corresponding Author. Corresponding address: The Wang Yanan Institute for Studies in Economics, Xiamen University, Fujian, China 361005. Email: yyuanwise@gmail.com. Phone: 86-592-218-1782.

Abstract

In this paper, we apply the theory of rational expectation bubbles to the Chinese house market. Rational expectation bubbles imply that negative returns on house prices are, theoretically, less likely to occur if the bubbles exist and persist. Based on the data of 29 cities in China, we find no evidence to support the existence of bubbles in the housing market.

JEL classification: R31; E31

Keywords: China house price; rational expectation bubble; hazard rate

1 Introduction

In the past 20 years, housing prices in China have grown rapidly. From 2003 to 2007, the average growth rate reached as high as 14% per year. For some cities, such as Beijing, the growth rate of house prices reached 22% annually during that period. If we consider rental income and capital income, then the return on housing capital exceeds that of the business sectors.[1] The high growth rate of house prices attracts substantial concern regarding the existence of price bubbles. It has become one of the major concerns of policymakers in China because a bubble burst will lead to serious consequences for the Chinese economy. Thus, it is important for us determine whether housing price bubbles actually exist in China. The major contribution of the paper is to provide a new method for answering this question.

Most related literature tests for house price bubbles by comparing the present values of the houses with the house market prices. The main debate in the literature is with respect to how to calculate the present value. One of the most popular methods is to discount future cash flows (rental income). However, future rental income in China is difficult to predict because rental income is affected by GDP, population density and other economic variables, and those economic variables continue to change over time. Thus, this approach is not appropriate.

Alternatively, other literature considers that house price increases can be explained by changes in economic fundamentals, such as income, construction costs, population and interest rates. House price bubbles are then defined as deviations from those fundamentals. For example, Mikhed and Zemcik (2009) suggest the oversized house price increases in increases in the U.S. cannot be explained by changes in the fundamentals between 1997

[1] Xin, Lin and Yang estimate the average return rate of the companies in Chinese stock markets. They display that the average return rate is around 2.6%. CCER(2007) displays that capital return has been increasing since 1998. The capital return of state-owned companies is 8% on average from 2003 to 2006. And the capital return of the private sectors is 17% on average from 2003 to 2006. Because the private sectors are financially constrained, the high return can be explained by their insufficient capital. The literature, such like Caggeti(2004), has shown that when financially constrained, the companies have higher capital return in equilibrium.

and 2006. McCarthy and Peach (2004) find that there is no bubble in the U.S. housing market and that changes in house prices reflect movements in the fundamentals, such as income and interest rates. [2] Himmel et al (2005) show that the sensitivity of house prices to the changes in fundamentals is high when long-term real interest rates are low and expected inflation is high. Hence, they argue that the rapid increase of house prices is not a signal of a bubble. However, this approach heavily depends on the choice of economic fundamentals, and the results are quite sensitive to which perspective of the fundamentals is considered.

As for the housing market in China, many researchers set up demand and supply functions for housing and use market equilibrium conditions to test for house price bubbles, but the definition of a bubble is vague in their papers. Moreover, Montrucchio and Privileggi (2001), among others, already proved that rational expectation bubbles are marginal and fragile in the general equilibrium. Hence, solid theoretical support does not exist for applying the equilibrium model to this area.

In this paper, we provide a new method to test for house price bubbles in China. We try to define house price bubbles by following the definition of rational expectation bubbles proposed by Blanchard and Watson (1983). Rational expectation bubbles are the only form of bubbles that can exist in efficient markets. Moreover, the features of the rational expectation bubbles are that the prices of the assets continue to increase over time and that their returns surpass the average capital return in the economy. These features match the dynamic path of Chinese house prices quite well during the past ten years.

Different from the literature, this paper adopts the method in McQueen and Thorley (1994), which is originally proposed to find stock market bubbles, to test for house price bubbles. Because the theory of rational expectation bubbles can be bubbles can be applied to any risky assets and McQueen and Thorley (1994) derive their method based on this

[2] This literature also include Shiller (1990), Clapp and Giaccotto (1994), Abraham and Hendershott (1994), Capozza et al (2002), Case and Shiller (2003), and Gallin (2006).

theory, their method can also be applied to house prices. To the best of our knowledge, we are the first to introduce this method into the housing literature, which is one of the main contributions of this paper. However, the method in McQueen and Thorley (1994) cannot be implemented directly. In the empirical analysis, we find that the data from the contain annual data for ten years, which is too limited to conduct the same application as McQueen and Thorley (1994). This limitation also makes it difficult to apply the method of cointegration or unit root tests, such as the application in Mikhed and Zemcik (2009). We solve this problem by extending the method into the panel data analysis for metropolitan areas. The method we use bypasses the arbitrary estimation of fundamental house values and avoids the theoretical weakness of general equilibrium models in the current literature for testing China's The basic idea behind our methodology is that the theory of rational expectation bubbles implies that negative returns on house prices are less likely to occur, theoretically, if bubbles exist and persist. However, based on the data of 29 cities in China, we find the hazard rate of positive returns is not a decreasing function of time. Thus, we suggest that there are no bubbles in the housing market of China.

The remainder of this paper is organized as follows. In Section 2, we display the model to test for house price bubbles. In Section 3, we illustrate the empirical results, and Section 4 concludes.

2 Model

2.1 Theoretical Model

Blanchard and Watson (1983) propose the definition of the rational expectation bubbles based on a simple efficient market condition, which states the expected return of a house is equal to the required return:

$$E_t[R_{t+1}] = r_t.$$

Here E_t denotes the expectation conditional on the information set of time t. And r_t is the required return on this asset at period t. R_{t+1} can be regarded as the return of owning house from period t to period $t+1$. Specifically,

$$R_{t+1} \equiv \frac{p^*_{t+1} - p^*_t + d_{t+1}}{p^*_t}.$$

Here p^*_t and p^*_{t+1} are the price levels of housing at periods t and $t+1$. d_{t+1} is the rental income of the house at period $t+1$. By holding a house from period t to period $t+1$, the investor can have two sources of revenues: the capital gain from the variation of the house prices and the rental income. After some rearrangement, the condition for a competitive equilibrium is equivalent to

$$p^*_t = \frac{E_t[p^*_{t+1} + d_{t+1}]}{1 + r_t}. \tag{1}$$

By repeatedly imposing the above conditions, we can get the expression defining the fundamental values of the house as

$$p^*_t \equiv \sum_{i=1}^{\infty} \frac{E_t[d_{t+i}]}{\prod_{j=0}^{i-1}(1 + r_{t+j})}.$$

We assume the market house prices, p_t, contain two components: the fundamental value and the bubble as $p_t = p^*_t + b_t$. Here b_t is denoted as the bubble. While as long as b_t satisfies

$$E_t[b_{t+1}] = (1 + r_t)b_t, \tag{2}$$

the condition (1) also holds for the market prices. It suggests that the market price can deviate from the fundamental value by a rational speculative bubble factor b_t. Equation (2) is the necessary condition of the bubbles existing in the competitive equilibrium. It implies that as long as the bubble component b_t grows over time and provides the required return r_t, the agents in the economy would like to hold the houses with price bubbles.

Following McQueen and Thorley (1994), we use ϵ_{t+1} to define the unexpected price changes of the houses. Since $p_{t+1} = p^*_{t+1} + b_{t+1}$, both the unexpected changes in the fundamental value and the unexpected changes in the bubble components can affect ϵ_{t+1}. That means $\epsilon_{t+1} = \mu_{t+1} + \eta_{t+1}$, where μ_{t+1}, η_{t+1} are the unexpected changes for the fundamental value and the bubbles respectively. The unexpected change in the fundamental value is defined by

$$\mu_{t+1} = p^*_{t+1} + d_{t+1} - (1 + r_t)p^*_t.$$

And the unexpected change in the bubble is defined by

$$\eta_{t+1} = b_{t+1} - (1 + r_t)b_t.$$

We assume that μ_{t+1} satisfies a symmetric distribution with mean 0. The symmetric assumption on the distribution of μ_{t+1} is made based on the fact that the fundamental value is usually believed to have mean-reversion property. In addition, we assume that b_t follows a two-point discrete distribution. With a probability of π, the bubble component b_t can persist and stay in the house price for the next period. With a probability of $1-\pi$, the bubble component b_t will burst and the left-over value is a_0. In order to make the equilibrium condition (Equation (2)) hold, b_{t+1} must satisfy the following condition

$$b_{t+1} = \begin{cases} \frac{(1+r_t)b_t}{\pi} - \frac{1-\pi}{\pi}a_0 & \text{with probability } \pi \\ a_0 & \text{with probability } 1-\pi \end{cases}. \tag{3}$$

Here, we assume $\pi \gg 1 - \pi$, which implies $\pi \gg 1/2$. This assumption is reasonable because, empirically, the probability for a bubble, no matter what the underlying asset is, to burst is much smaller than to persist. We can observe this stylized fact from stock markets, housing markets around the world. Furthermore, intuitively

$$\frac{(1 + r_t)b_t}{\pi} - \frac{1 - \pi}{\pi}a_0 > a_0 \geq 0. \tag{4}$$

This means if the bubble persists, its realized value is larger than the value when it bursts.

By plugging the equation (3), we can transform the equation $\epsilon_{t+1} = \mu_{t+1} + \eta_{t+1}$ into

$$\epsilon_{t+1} = \begin{cases} \mu_{t+1} + \frac{(1-\pi)}{\pi}\left[(1+r_t)b_t - a_0\right] & \text{with probability } \pi \\ \mu_{t+1} - (1+r_t)b_t + a_0 & \text{with probability 1-}\pi \end{cases} \tag{5}$$

We define the probability of observing the negative abnormal return as the following

$$\lambda_{t+1} \equiv \text{Prob}[\epsilon_{t+1} < 0],$$

which can be expressed as

$$\lambda_{t+1} = \pi F\left[-\frac{(1-\pi)}{\pi}((1+r_t)b_t - a_0)\right] + (1-\pi)F\left[(1+r_t)b_t - a_0\right].$$

Here $F(\cdot)$ is the cumulative density function of the unexpected changes of the fundamental value μ_{t+1}. Let us look at the first order partial derivative of λ_{t+1} with respective to b_t,

$$\frac{\partial \lambda_{t+1}}{\partial b_t} = -(1-\pi)(1+r_t)\left[f(-\frac{(1-\pi)}{\pi}((1+r_t)b_t - a_0)) - f((1+r_t)b_t - a_0)\right].$$

Since $\pi > 1/2$ and f is symmetric around 0, $\frac{\partial \lambda_{t+1}}{\partial b_t} < 0$. That means the probability of observing negative unexpected price changes will become less likely as the bubble grows. Just as stated by McQueen and Thorley (1994), when the bubble component grows, it starts to dominate the fundamental values. The negative unexpected price changes are less likely to happen and happen primarily when the bubbles crash.

Usually, we care the returns much more than the price changes. If the return is

$$e_{t+1} \equiv \frac{\epsilon_{t+1}}{p_t},$$

then $\text{Prob}[e_{t+1} < 0] = \text{Prob}[\epsilon_{t+1} < 0]$. So the previous argument can apply to the return as well, namely

$$\frac{\partial \text{Prob}[e_{t+1} < 0]}{\partial b_t} < 0.$$

The theoretical model demonstrates that if the prices contain bubbles and we observe a sequence of positive abnormal returns, it is highly possible that the bubble components exist, persist and grow over time. And growing bubble components leads to smaller probability of observing negative abnormal returns. Therefore, we can get the necessary condition for the existence of the bubbles: the probability of negative abnormal returns will decrease as the length of the existence of the bubbles. If we use $h(T)$ to denote the hazard rate of *positive* abnormal returns and T to denote the number of periods of *positive* abnormal returns (run length), the necessary condition for the bubbles existing is

$$\frac{\partial h(T)}{\partial T} < 0, \tag{6}$$

where $h(T) = \text{Prob}(e_t < 0 | e_{t-1} > 0, e_{t-2} > 0, \cdots, e_{t-T} > 0, e_{t-T-1} < 0)$.

2.2 Model Implementation

McQueen and Thorley (1994) apply Equation (6) to test for bubbles in the U.S. stock market. They use the monthly returns of portfolios (equally weighted or value-weighted) of all New York Stock Exchange (NYSE) stocks from 1927 to 1991. They compute the time series of unexpected returns and, hence, the hazard rates $h(T)$ under the assumption that the abnormal return is independent and identical distribution ($i.i.d$) over the time horizon. Then, they test whether or not $h(T)$ satisfies Equation (6).

However, this method cannot work in the housing market of China. China started the commercialization of houses in the middle of the 1990s, and only annual data are available. Therefore, there are no more than 15 data points in the time series. The problem of small samples will generate large errors when computing hazard rates. To alleviate this problem, we propose to use the panel data of 29 cities. In addition, we need an assumption that the abnormal return is *i.i.d.* across time and cities.

As discussed in Equation (5) of section 2, the unexpected house price changes of city i at period t, ϵ_t^i satisfies

$$\epsilon_t^i = \begin{cases} \mu_t^i + \frac{(1-\pi^i)}{\pi^i}\left[(1+r_{t-1}^i)b_{t-1}^i - a_0^i\right] & \text{with probability } \pi^i \\ \mu_t^i - (1+r_{t-1}^i)b_{t-1}^i + a_0^i & \text{with probability } 1\text{-}\pi^i \end{cases}$$

We compute the real house return of city i at period t as follows

$$R_t^i = \frac{(p_t^i + d_t^i)}{p_{t-1}^i} - 1,$$

where p_t^i denotes the price in city i at time t. In order to perform the test, we need to compute the unexpected returns. The unexpected return is the difference of the realized return and the expected return. Hence, if we denote e_t^i as the unexpected returns of city i at period t, then

$$e_t^i = R_t^i - E_{t-1}(R_t^i).$$

House returns consist of two components: rental income d_t^i and capital income from house price variations $p_t^i - p_{t-1}^i$. Thus, we must focus on the variations of these two components to forecast returns. We assume that rental income is highly persistent and can be forecasted by its lag values. Therefore, we add the lag rent-price ratio dp_{t-1}^i into the list of explanatory variables to capture the effects of d_{t-1}^i on house returns. In addition, Gallin (2006) suggest that the changes of fundamentals reflect house price variations $p_t^i - p_{t-1}^i$, such as personal income, construction costs, usage costs of housing and interest rates. Hence, we include the growth rate of GDP per capita to capture the effects of income growth on house price changes. Finally, the expected returns depend on the required rates for future cash flows, which fluctuate with the business cycle: low in peaks and high in troughs. Fama and French (1989), among others, confirms this point by checking stock returns. Their explanation is that in economic recessions, people require high expected returns to compensate for risks brought by macroeconomic uncertainty. Here, we regard the unemployment rate as a measurement for economic conditions. By adding it to the explanatory variables of the regression, we can reveal how macroeconomic risks affect expected returns in the housing market.

As we are studying 29 different cities, there may exist some idiosyncratic factors, which are not time-varying for each city. Therefore, we employ the fixed-effect model to forecast the house returns

$$R_t^i = \beta_0 + f_i + \beta_d dp_{t-1}^i + \beta_g g_{t-1}^i + \beta_u u_{t-1}^i + e_t^i, \tag{7}$$

where f_i is unobservable city characteristics; $dp_{t-1}^i = \frac{d_{t-1}^i}{p_{t-1}^i}$ is the ratio of rental income to house price; g_{t-1}^i is the growth rate of GDP per capita; and u_{t-1}^i is the unemployment rate. The left-hand side of Equation (7) represents the realized return for each period, and the right-hand side but e_t^i represents the expected return $E_{t-1}(R_t^i)$. The residual of the regression, e_t^i, is treated as the unexpected return.

3 Empirical Analysis

3.1 Data

Table 1 displays all data used in this paper. For the first six variables of the table, we collect the panel data for 29 cities[3]. For the last variable, stock returns, we have only one time series. Figure 3.1 displays the locations of the cities. All of the cities but one are located in the southeast area of China. The selected cities are also consistent with the population distribution: 46.35% of the population is concentrated in the southeast area, which represents only 20.35% of the land in this country. We divide the output growth

[3] They are Shanghai, Beijing, Tianjin, Hangzhou, Guangzhou, Nanjing, Fuzhou, Shenyang, Jinan, Haerbin, Shijiazhuang, Wulumuqi, Changchun, Haikou, Neimenggu, Wuhan, Taiyuan, Chongqing, Changsha, Zhengzhou, Yinchuan, Xining, Nanning, Chengdu, Hehui, Nanchang, Xi'an, Lanzhou, Guiyang.

rate and the stock returns by the consumer price index to obtain the real values of these variables.

Table 1: Data Description

Item	Variables	Notation	Year	Resources
1	House Price	p_t^i	1999-2008	China Estate Statistics Year Book
2	Rental Income	d_t^i	1998-2008	China Estate Statistics Year Book
3	Ouput Growth Rate	g_t^i	1998-2008	National Bureau of Statistics of China
4	Unemployment Rate	u_t^i	1998-2008	National Bureau of Statistics of China
5	CPI	c_t^i	1998-2008	National Bureau of Statistics of China
6	Population	h_t^i	1998-2008	National Bureau of Statistics of China
7	Stock Return	s_t	1998-2008	Wind.NET

i denotes city; and t denotes time.

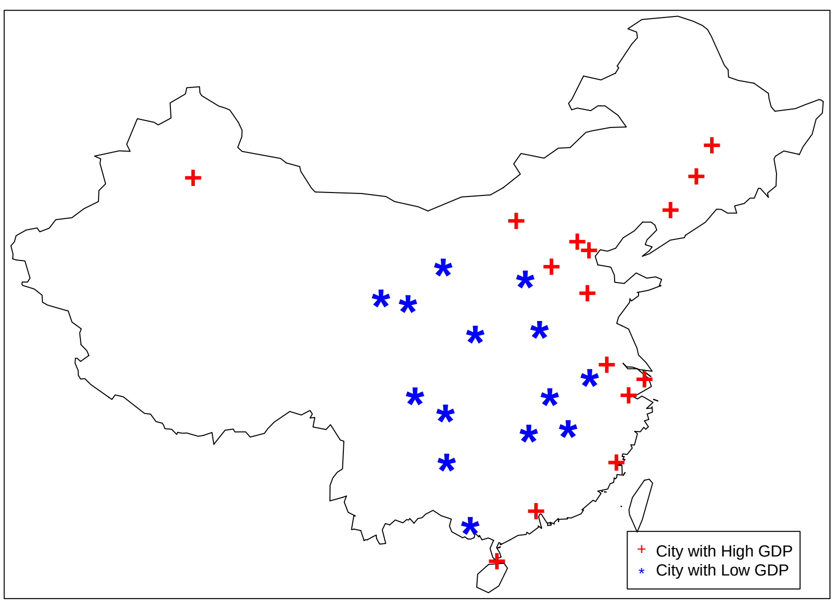


Figure 1: This figure displays the locations of the 29 cities studied in our paper.$'+'$denote high GDP cities, $'*'$denote low GDP cities.For more information of the cities, please refer to the Appendix 1.

3.2 Empirical Results

Table 2 displays the empirical results based on Equation (7). β_d is the estimated coefficient for the independent variable: the rental-price ratio dp_t. The estimator is positive, significant and close to 1. The rate of house return at period $t+1$ is equal to $\frac{d_{t+1}}{p_t} + \frac{[p_{t+1}-p_t]}{p_t}$, i.e., the summation of rental income and capital income from price changes. The rent is very persistent over time. Hence, dp_t, i.e., the rent-price ratio $\frac{d_t}{p_t}$ of t period, can be used to predict $\frac{d_{t+1}}{p_t}$. However, the high value of the rent-price ratio implies that the cash flow from owning a house is high. Thus, investors are more likely to increase their investments in houses. Then, house prices will increase in the future, which leads to an increase in capital income from price changes in the future. Therefore, the lagged rental-price ratio is positively related to the rate of house returns, and the estimator is close to 1, as suggested by our regression results.

In addition, β_u is positive and significant as well. The unemployment rate reflects the conditions of the business cycles. The unemployment rate is high when the economy is in recession. Hence, the positive estimator for β_u implies that the expected return increases according to the fall of the economy. This result is consistent with the paper by Fama and French (1989), which shows that the expected rates of stock returns are higher in poor economic times. Their explanation for this empirical result is that higher expected rates of asset returns are required in the troughs of the business cycle to compensate for the higher risks generated by a poor macroeconomic situation. We can also explain this result from another perspective. When the economy is in a trough, asset prices, including house prices, are low because of high liquidity risks and pessimistic expectations about the future of the economy. However, in the future, when the economy recovers, both rents and house prices increase, which generates a higher rate of house returns in the next period.

The most interesting result that we obtain is that the estimated coefficient for the independent variable, the real GDP growth rate, i.e., β_g, is insignificant. As we know, regional development in China is quite unbalanced. The differences of real GDP growth rates (per capita) reflect the differences of the income growth of each city. However, in the empirical result, we find that this variable does not significantly affect the expected returns on housing assets in the different cities. This finding implies that capital from housing can flow freely across the different cities of China so as to completely eliminate the influence of local economic fundamentals.

Table 2: Estimation Results

Parameter	Estimator	Std.Err.	t-statistic	P-value
β_d	1.13	0.10	11.79	0.00
β_g	-0.06	0.05	-1.20	0.23
β_u	1.54	0.44	3.53	0.00
constant	0.95	0.02	39.55	0.00
R^2	0.39			

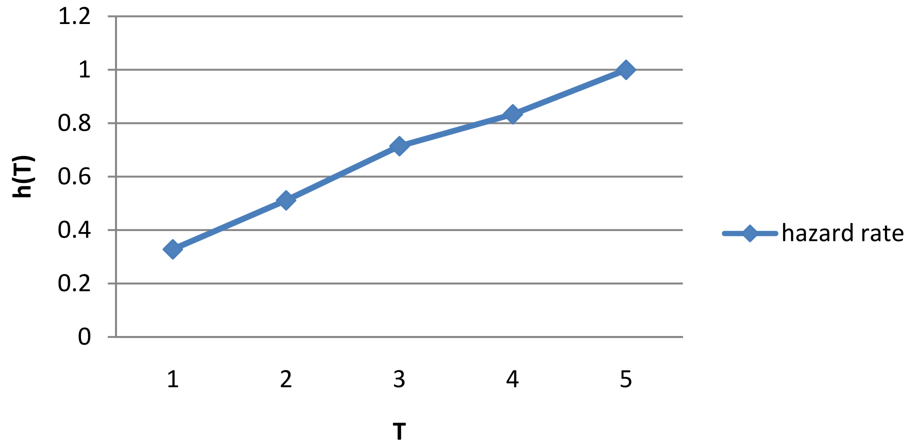
Next, we collect the residuals and transfer them by counting the numbers of the run lengths on 29 cities individually. The hazard rate is obtained based on the run length numbers, reported in Table 3.

Table 3: Hazard Rates

T	n	N	$h(T)$
1	21	64	0.33
2	22	43	0.51
3	15	21	0.71
4	5	6	0.83
5	1	1	1.00

The first column, T, indicates the run length. The second column, n, shows the number of the runs for which the length corresponds to the length shown in the first column, and the third column, N, is the total number of runs for which the lengths are equal to or longer than the corresponding number in the first column. Thus, the hazard rate $h(T)$ is the ratio between n and N. We graph the hazard rates in Figure 2, which shows that the rate is not decreasing with the run length. This result does not satisfy the necessary condition of the existence of price bubbles. Therefore, we may conclude that there is no bubble in the housing market of China.

Figure 2: Hazard rate for the whole sample



3.3 Robustness Check

GDP per capita varies greatly across the provinces of China. In the previous analysis, we did not control for this variable because of its non-stationarity. Here, we divide the 29 cities into two groups in terms of their average GDP per capita from 1999 to 2008. As for the names of the cities in each group, please refer to the Appendix.

We repeat the analysis that we have done for each group. The results are summarized by Tables 4, 5, 6 and 7. The hazard rates for the high- and the low- GDP cities are graphed in Figures 3 and 4.

An interesting result is that the unemployment rate is significant for the high-GDP cities but not for the low-GDP cities. This finding indicates that expected house returns depend on the cyclical conditions of the local economy in the rich regions, whereas they do not in the poor regions. We know that the cyclical conditions of the local economy affect the asset holders in their required returns. Therefore, the above results imply that the local economies of the poor regions do not affect the expected returns of their housing

Table 4: Estimation for High GDP Cities

Parameter	Estimator	Std.Err.	t-statistic	P-value
β_d	1.14	0.15	7.46	0.00
β_g	-0.24	0.08	-0.29	0.77
β_u	1.79	0.55	3.20	0.00
constant	0.94	0.04	26.59	0.00
R^2	0.35			

Table 5: Hazard Rates for High GDP Cities

T	n	N	$h(T)$
1	11	31	0.35
2	8	20	0.4
3	9	12	0.75
4	2	3	0.67
5	1	1	1.00

Table 6: Estimation for Low GDP Cities

Parameter	Estimator	Std.Err.	t-statistic	P-value
β_d	1.13	0.11	9.89	0.00
β_g	-0.06	0.064	-0.87	0.39
β_u	0.64	0.77	0.83	0.41
constant	0.97	0.03	28.79	0.00
R^2	0.48			

Table 7: Hazard Rates for Low GDP Cities

T	n	N	$h(T)$
1	12	35	0.34
2	16	23	0.69
3	4	7	0.57
4	3	3	1.00

Figure 3: Hazard Rate for high GDP cities

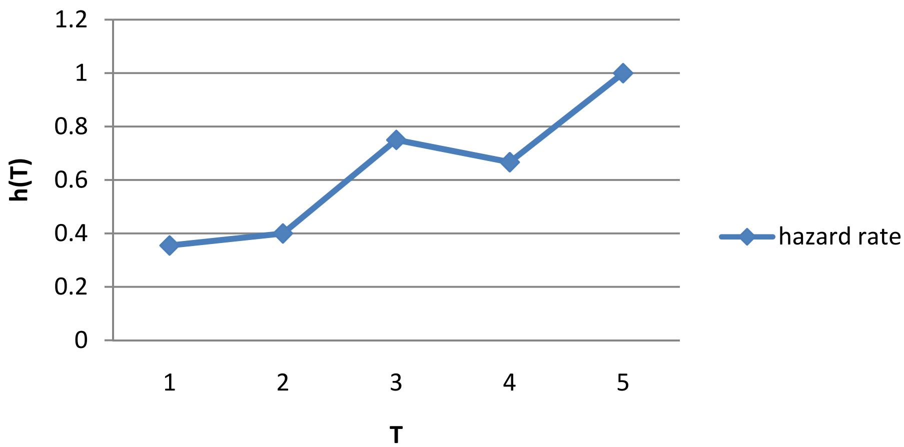
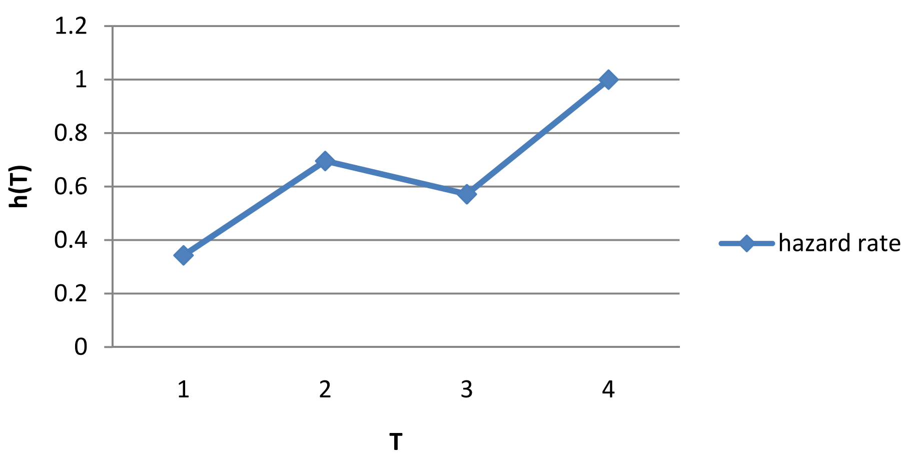


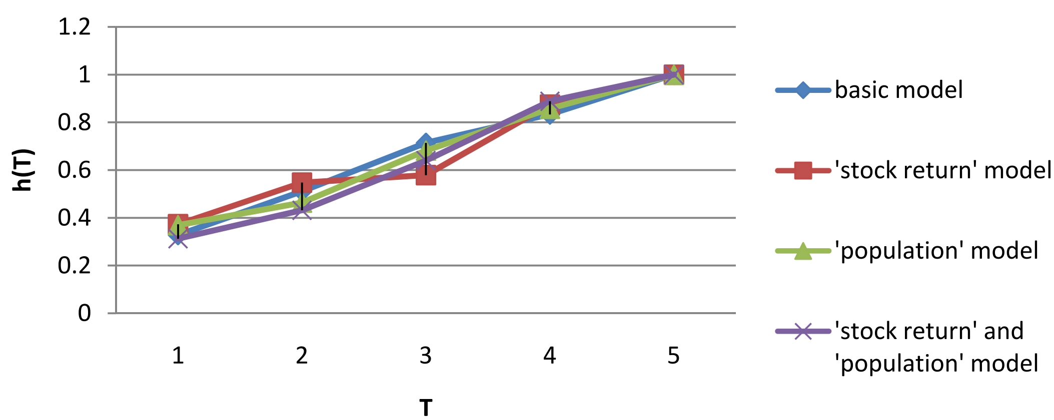
Figure 4: Hazard Rate for low GDP cities



asset holders. One possible explanation is that the majority of the housing assets in the poor regions are held by the people from the rich regions. Furthermore, we have not yet found any evidence to support the decreasing hazard rates for each group, which implies that there is no bubble in the housing market of China after controlling for the effect of GDP per capita. Although, considering the average GDP in poor regions, housing prices seem unbelievably high, they may be still reasonable with respect to the rich regions.

In addition, the population growth rate (pop) and stock return rate (sr) may also affect expected returns. To check the robustness of our results, we place the two variables into the basic model and run the fixed effect model for the whole sample. Table 8 reports the estimation results for the different models. Model I is the original model discussed in the previous section. It is regarded as a benchmark. In Models II and III, we add either the stock return rates or the population growth rate to the explanatory variable, and Model IV includes all of the variables. Table 9 shows the hazard rates for the four models. The hazard rates for all of the samples in different models are graphed in Figure 5:

Figure 5: Hazard Rate for different models



In Figure 5, it is clear that when adding the additional variables, such as the population growth rate and/or the stock returns, into our model, we obtain similar results. The existence of a Chinese housing bubble is not supported by the data.

Table 8: Models with Different Explanatory Variables

Estimation Results	Model I basic model	Model II 'sr' added	Model III 'pop' added	Model IV 'sr' and 'pop' added
cons	0.95	0.98	0.89	0.92
t-statistics	41.36	43.47	26.68	28.53
p-value	0.00	0.00	0.00	0.00
β_d	1.13	1.00	1.17	1.05
t-statistics	11.79	10.62	12.16	11.08
p-value	0.00	0.00	0.00	0.00
β_g	-0.06	0.01	0.00	0.08
t-statistics	-1.20	0.26	0.02	1.44
p-value	0.23	0.79	0.98	0.15
β_u	1.53	1.19	1.85	1.52
t-statistics	3.53	2.84	4.11	3.51
p-value	0.00	0.00	0.00	0.00
β_{sr}		-0.02		-0.02
t-statistics		-5.14		-5.29
p-value		0.00		0.00
β_{pop}			5.14	5.44
t-statistics			2.46	2.73
p-value			0.35	0.00
R^2	0.39	0.45	0.41	0.46

Table 9: Hazard Rates for Different Models

run length	Model I hazard rate	Model II hazard rate	Model III hazard rate	Model IV hazard rate
1	0.33	0.37	0.37	0.31
2	0.51	0.54	0.46	0.43
3	0.71	0.58	0.68	0.64
4	0.83	0.88	0.86	0.89
5	1.00	1.00	1.00	1.00

4 Conclusion

This paper tests for house price bubbles in China. We apply the method proposed by McQueen and Thorley (1994) to test for test for rational expectation bubbles, as defined by Blanchard and Watson (1983). We find that the house returns in Chinese cities do not satisfy the necessary conditions for the existence of a bubble. We also reveal that our result is quite robust to the model and the data that we use. This finding means that house price bubbles are not a solid reason for the rapid growth of China's house prices.

Additionally, we also find two interesting results. First, the GDP growth rate cannot affect the local expected returns of houses both in the whole group and subgroups of data. As we have discussed in the previous sections, house capital flows freely across different regions and, hence, eliminates the influence of the local economy on the expected rate of house returns. Given the rapid growth of house prices, the government now is confronted with the pressure to reduce the growth rate of house prices in certain cities and increase house prices consistent with income growth. Thus, this result implies that to fulfill this purpose, it is necessary to block the free flow of house capital between the cities, such that the expected house returns will vary with the local growth rate of income. Policies such as placing restraints on the purchases of houses by non-locals can work in this direction.

Second, in the subgroups of the data in the poor regions, we find that the volatility of business cycles cannot affect the expected returns of houses. If the local population holds the majority of the house values, then this result is then not consistent with the results of Fama and French (1989) and many others. Hence, our conclusion is that the housing asset holders in poor regions primarily come from the rich regions. Since 1990, a large share of the labor force in the poor regions has been seeking employment in the rich regions. With higher salaries, these people can better afford housing in the poor regions, although they cannot pay the much higher house prices of the rich regions where they work. Therefore, those that return to their hometowns become dominant in the local commercialized housing markets of the poor regions. For those people, neither the local economy nor the local unemployment will affect their portfolio choices for house purchases. This result implies that, due to the large variations in economic development among the regions of China, it is necessary to take this difference into consideration in the research on the Chinese housing market.

To explore the mechanisms behind the rapid increase of house prices further, we need to carefully examine demand and supply in the Chinese housing market. China has been experiencing a period of extraordinary changes, both in income growth and urbanization. We also know that the government is the dominant power in terms of land supply in China. Do these special features of the Chinese housing market affect the dynamics of Chinese house prices? These questions are left for future research.

References

Abraham J, Hendershott P. Bubbles in Metropolitan Housing Markets. NBER Working Papers 1994.

Blanchard O, Watson M. Bubbles, Rational Expectations and Financial Markets. NBER working papers 1983.

Capozza D, Hendershott P, Mack C, Mayer C. Determinants of Real House Price Dynamics. NBER Working Papers 2002.

Case K, Shiller R. Forecasting Prices and Excess Returns in the Housing Market. Real Estate Economics 1990; 18 (3); 253-273.

Case K, Shiller R. Is There a Bubble in the Housing Market?. Brookings Papers on Economic Activity 2003; 34(2); 299-362.

Clapp J, and Carmelo G. The Influence of Economic Variables on Local House Price Dynamics. Journal of Urban Economics 1994; 36(2); 161-183.

Fama E, French K. Business conditions and expected returns on stocks and bonds. Journal of Financial Economics 1989; 25(1); 23-49.

Gallin J. The Long-Run Relationship between House Prices and Income: Evidence from Local Housing Markets. Real Estate Economics 2006; 34(3); 417-438.

Himmelberg C, Mayer C, Sinai T. Assessing High House Prices: Bubbles, Fundamentals and Misperceptions. Journal of Economic Perspectives 2005; 19(4); 67-92.

McCarthy J, Peach R. Are home prices the next Bubble? Economic Policy Review 2004; (Dec); 1-17.

McQueen G, Thorley S. Bubbles, Stock Returns, and Duration Dependence. Journal of Financial and Quantitative Analysis 1994; 29(03); 379-401.

Mikhed V, Zemcik P. Do House Prices Reflect Fundamentals? Aggregate and Panel Data Evidence. Journal of Housing Economics 2009; 18 (2); 140-149.

Montrucchio L, Privileggi F. On Fragility of Bubbles in Equilibrium Asset Pricing Models of Lucas-Type. Journal of Economic Theory 2001; 101 (1); 158-188.

Appendix:

Population in Southeast Area

The southeast area includes Shanghai, Tianjin, Beijing, Jiangsu, Shandong, Guangdong, Zhejiang, Fujian, Anhui, Hebei, Liaoning, Jilin, Heilongjaing and we calculate the population, area squares and then, get the population ratio.

Cities' Locations

High GDP Cities: Shanghai, Beijing, Tianjin, Hangzhou, Guangzhou, Nanjing, Fuzhou, Shenyang, Jinan, Haerbin, Shijiazhuang, Wulumuqi, Changchun, Haikou;
Low GDP Cities: Neimenggu, Wuhan, Taiyuan, Chongqing, Changsha, Zhengzhou, Yinchuan, Kunming, Xining, Nanning, Chengdu, Hehui, Nanchang, Xian, Lanzhou, Guiyang;