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E C O N O M I C S B U L L E T I N

The Rise in House Prices in China: Bubbles or Fundamentals?

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Abstract

The dramatic rise of house prices in many cities of China has brought huge attention from both the governmental and academic circles. There is a huge debate on whether the increasing house prices are driven by market fundamentals or just by speculation. Like Levin and Wright (1997a, 1997b), we decompose house prices in China into fundamental and non−fundamental components. We also consider potential nonlinear feedback from the historical growth rate of house prices on the current house prices and propose a semiparametric approach to estimate the speculative components in the model. We demonstrate that the non−fundamental part contributes a relatively small proportion of the rise of house prices in China.

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1. Introduction

The house price in China has risen dramatically in the last 15 years. This has brought huge attention from both the governmental and academic circles. One obvious question is what has caused the rise of house prices in China. In this paper, we argue that the increasing house prices are driven by both economic fundamental and speculation but the former plays the key role.

Speculative purchases in the housing market are largely attributed to the apparent predictability in house prices, at least in the short run. House price speculation is often defined as the purchase of a house at current time motivated by the expectation of a real increase in the price of a house in the future. The literature on speculation in the housing market is large. See Case and Shiller (1989), Levin and Wright (1997), Muellbauer and Murphy (1997), Riddel (1999), Chan et al. (2001), among many others. Many of these studies start with decomposing the house price into different components, and find strong evidence of speculative behavior in various housing markets. There are several ways to decompose the actual house price into two components: one is driven by the economic or market fundamental, and the other is due to speculation on the housing market. They are different in how they specify the determination mechanism for the economic fundamental price or non-fundamental price.

Two commonly used models of non-fundamental asset prices are the stochastic bubble model proposed by Blanchard and Watson (1982) and the fad model proposed by Summers (1986). Levin and Wright (1997a, 1997b) consider modeling speculation in the housing market in terms of historical growth rates of house prices. The central hypothesis of this approach is that shifting demand conditions on the housing market stem from a positive feedback of historical price changes on expectations about future price change. As Levin and Wright (1997b) argue, these shifting demand conditions affect the equilibrium house prices. When the historical prices have no effect on the current expectation of future capital gains on resale of a house, there will be no speculation in the housing market.

There is no unique way to model the market fundamentals. One possible choice is to use rental incomes. When we treat real estate as a good investment, which produces a stream of rental incomes over its lifetime. The current value of a house is therefore determined by the present value of the cash flow from all the rental incomes. Consequently, the current value can be defined as the fundamental price of a house. If the actual price is consistent with this price, the so-called market fundamental hypothesis cannot be rejected. Otherwise, deviations from the fundamental model will occur, and it is possible to detect the magnitude of the deviations. This approach is taken in Chan et al. (2001) when they test for rational bubbles in the residential housing markets of Hong Kong. A second choice is to use macroeconomic or geographic variables, like in Levin and Wright (1997a, 1997b), Muellbauer and Murphy (1997), and Riddel (1999). For example, Levin and Wright (1997a, 1997b) choose real income and real interest to model the fundamental prices whereas Roche

(2001) chooses real disposable income, real interest rate and net migrants. For an early review on the housing price from the demand side, see Megbolugbe et al. (1991).

This paper explores the issue based upon the framework of Levin and Wright (1997a, 1997b). In comparison with other approaches to model the fundamental or non-fundamental prices, their work is intuitively appealing. Furthermore, the data used in their analysis are relatively easy to obtain in China. In comparison with their work, we also consider potential nonlinear feedback from the historical growth rate of housing price on the current house price and propose a semiparametric approach to estimate the speculative components in the model.

The paper is structured as follows. In Section 2 we introduce the theoretical framework of our analysis. We estimate our model using China's data in Section 3. Section 4 concludes.

2. Theoretical Framework

The central hypothesis of this paper is that the rise of house price is determined not only by economic fundamentals but also speculation in the housing market.

In a housing market void of speculative influence, the market price for a house is jointly determined by a demand function and a supply function. The existence of a large number of "second-hand" houses relative to newly completed houses means that the total stock of houses is effectively fixed in the short-run. In this sense, prices must adjust in order to reflect the economic value of this fixed number of dwellings. Therefore, real house price fluctuations are caused primarily by the demand side in the short run.

When speculation exists in the housing market, as Riddel (1999) put it, the mechanisms by which speculation may occur in the housing market are manifold. But in all cases, speculation is determined by the expectation of a future price change and can only occur if there is a "belief" that prices will change. Without this expectation of price movement, there can be no gain from speculation. The analysis of house price speculation must therefore address the question of what causes the belief that prices will change.

Like Levin and Wright (1997a, 1997b), we decompose the market price in period *t*, P_t , into two components: P_t^f and P_t^s. P_t^f is attributable to the economic fundamentals, assuming the expectation of zero capital gain, and P_t^s is attributable to expected capital gains or losses due to expected price changes over the next few periods. That is:

$$P_t = P_t^f + P_t^s \qquad (2.1)$$

The first component of house prices P_t^f is the money valuation placed on house occupancy. We expect it to be related to both income y and the short-term interest rate

i. Houses are normal goods. As income increases, more houses are demanded. A rise in the interest rate increases mortgage payments and decreases the house demand. The money value placed on house occupancy is therefore negatively associated with interest rate because of an income effect in general. For this reason, we write P_t^f as a function of income and interest rate:

$$P_t^f = f_1(y_t, i_t) \qquad (2.2)$$

The second component of house prices P_t^s is associated with what causes the belief that prices will change. The simplest assumption that encompasses the various speculative mechanisms aforementioned is that the expected capital gain on house investment is determined by the last *d* periods of price growth. That is

$$P_t^s = f_2(g_{t-1}, ..., g_{t-d}) \qquad (2.3)$$

where, for example, $g_{t-i} = 100(P_{t-i} - P_{t-i-1})/P_{t-i-1}$ is the growth rate of house prices from period *t-i-1* to *t-i*, with *i=1,…,d*. Substituting (2.2) and (2.3) into (2.1), we have the following house price expression:

$$P_t = f_1(y_t, i_t) + f_2(g_{t-1}, ..., g_{t-d}) \qquad (2.4)$$

In the absence of housing speculation, one would expect the second term on the right hand side of (2.4) is insignificantly different from 0. The hypotheses consistent with our model of house price speculation are:

$$\frac{\partial P}{\partial y} > 0, \ \frac{\partial P}{\partial i} < 0, \ \frac{\partial P}{\partial g_{t-i}} > 0, \ i=1,\ldots,d. \qquad (2.5)$$

3. Empirical Evidence

In this section we evaluate the impact of economic fundamentals and speculation on house prices using quarterly data in China covering the period 1990.I-2005.I. In the first part of this analysis, a parametric model is estimated to test the housing speculation hypotheses. We obtain quarterly data in nominal house price, income (gross domestic product, GDP) and interest rate. We obtain real house price, real income and real increase rate by using the retail price index to discount the nominal ones. Let P_t^r and y_t^r denote the house price and real income, respectively. Since both of them exhibit seasonality, we obtain the seasonally-adjusted data by averaging: $P_t = \sum_{i=0}^{3} P_{t-i}^r / 4$, and $y_t = \sum_{i=0}^{3} y_{t-i}^r / 4$. The following variables are used in our empirical analysis: P_t : seasonally adjusted real house price; y_t : seasonally adjusted

real income (GDP); i_t : real interest rate; g_t : growth rate of real house price.

3.1 Parametric modeling and estimation

First, we approximate f_1 and f_2 in (2.4) linearly by the following linear model.

$$P_t = \beta_0 + \beta_1 y_t + \beta_2 i_t + \sum_{i=1}^{d} \beta_{2+i} g_{t-i} + u_t \qquad (3.1)$$

One could use some model selection criteria such as AIC and BIC to determine the number of periods *d* that should enter (3.1). Here, we consider choosing different *d* and see how the model is sensitive to the choice of *d*.

Also, using the ADF test, we find both P_t and y_t are unit root processes of order 1 and the process i_t is stationary. We test the null hypothesis of cointegration between P_t and y_t in the absence of exogenous regressors ($i_t, g_{t-1}, \ldots, g_{t-4}$), we find that P_t and y_t are cointegrated. This means that it is sensible to regress P_t on y_t and other random variables. Table 1 reports the regression results.

We make several remarks based on the observations from Table 1. First, for different choices of *d*, the effect of the economic fundamentals y_t and i_t on the house price remains pretty stable. The sign on the coefficients of both y_t and i_t is consistent with our hypothesis. Second, the coefficients of g_{t-i} （*i=1,2,3*） are significant at the conventional levels for the first three choices of *d*, implying that there does exist speculation on the housing market in China. The positive signs mean that if a speculator sees a rise in house price in the last couple of quarters, he will likely bet an increase of house price for the next quarter. When *d=4*, the coefficients of g_{t-i} （*i=1,2,3*） are not significantly different from *0*. This may arise from the multicollinearity between g_{t-i}'s Therefore, we think *d=3* is the best choice here.

Table 1: Parametric estimation: Sample :1990I-2005I

	D=1	*D=2*	*d=3*	*d=4*
Variables	Coefficient	Coefficient	Coefficient	Coefficient
constant	629.04(0.000)	624.51(0.000)	624.92(0.000)	624.94(0.000)
y_t	0.0754(0.000)	0.0756(0.000)	0.0755(0.000)	0.0752(0.000)
i_t	-31.19(0.000)	-31.74(0.000)	-32.35(0.000)	-32.69(0.000)
g_{t-1}	10.968(0.000)	8.200(0.013)	7.003(0.025)	4.712(0.132)
g_{t-2}		6.241(0.064)	4.136(0.025)	4.613(0.197)
g_{t-3}			7.159(0.029)	3.866(0.279)
g_{t-4}				8.693(0.009)
R^2	0.976	0.978	0.979	0.980
Adjusted R^2	0.974	0.976	0.978	0.978

Note: numbers in brackets are *p*-values.

3.2 Semiparametric modeling and estimation

Now, we approximate f_1 and f_2 in (2.4) linearly by the following partially linear additive model

$$P_t = \beta_1 y_t + m_1(i_t) + \sum_{i=1}^{3} m_{i+1}(g_{t-i}) + u_t \qquad (3.2)$$

where $m_j(\bullet)$, *j=1,…,4,* are functions of unknown form. Like Li (2000), we choose $m_j(0) = 0$, *j=2,…, 4,* as our identification condition. We estimate (3.2) using the series method proposed by Li (2000). To be specific, we approximate $m_j(\bullet)$, *j=1,…,4,* by the K_n terms Legendre polynomials, where K_n is the integer part of $2.5n^{1/4}$ and n is the number of observations. For other computational details, see Li (2000).

The semiparametric estimate for β_1 is 0.0761, which is not significantly different from its parametric estimate (0.0755) for the case *d=3*. We denote $\widehat{P}_t^b = \sum_{i=1}^{3} \widehat{m}_{i+1}(g_{t-i})$, where $\widehat{m}_{i+1}$s are the estimate of m_{i+1} obtained from the

series method. Therefore $\widehat{P}_t^b$ can be regarded as the contribution to the house price due to the speculation in the housing market.

4. Concluding Remarks

There has been huge debate on the housing market in China and particularly on whether the increasing houses prices are driven by market fundamentals or just by speculation. We use quarterly data in China from the period 1990I to 2005I to study the determination of the housing price in China and find that the price is mainly driven by market fundamentals. Speculation component does exist in the housing market but it contributes little on the variation of the housing prices.

Due to data limitation, our analysis is based on the aggregated data in the country. Since the housing markets vary a lot across different cities and provinces in China, future analysis should be based on data on the city or provincial level. Also, we observe that prices are quite different for different types of houses even in the same city, one can further study on the determination of housing price based on different segment of the housing markets.

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