Evaluation of the Existence of a Housing Bubble in China

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Abstract:

Housing prices in China's real estate market has been grown rapidly since 2003. Economists speculate that these high prices are the result of a bubble in China's housing market; however, sufficient findings to support this perspective have yet to be published. Not only has insufficient evidence been found to support the speculation regarding a housing bubble in China's real estate market, but also the proper methodology to test for a bubble's existence is hotly debated amongst academics. This debate around methodology focuses on what exactly are the characteristics that constitute a bubble even before a price downturn in the market can be observed. In this paper, I provide an empirical test on China's housing bubble by decomposing housing prices into fundamental and non-fundamental components, utilizing the fad-bubble regime-switching model developed by Van Norden and Schaller (1994) to test the movement of non-fundamental housing prices in China. After thoroughly testing economic indicators on housing prices in 35 Chinese cities, my findings suggest evidence of a speculative bubble in some Chinese cities, all of which are mainly characterized by both a high gross domestic product (GDP) and income level.

I. Introduction

China fully opened its housing market in 1999. Since that time, housing prices in China have continued to grow rapidly. According to the Chinese National Bureau of Statistics, the real estate sector already accounted for more than 30% of total GDP growth in 2004. As of 2009, the average housing price in 35 of China's largest cities has increased more than three-fold compared to the average housing price in 1998. In some large cities, the price of real estate even grew by 30% per year. If we look at the recent time-series data on housing price and several economic indicators, the trends in these variables show many similarities to the trends of U.S. pre-bubble data (See Figure A & B). With the collapse of U.S. housing bubble and the outbreak of the resulting financial crisis, more and more people have begun to suspect that the bubble phenomenon exists in China's housing market.

This paper is organized as follows: Section II will discuss how economists define a bubble and will provide a careful definition for housing bubbles that will be utilized in this paper. Section III will introduce the fads-bubble regime-switching model proposed by Van Norden and Schaller (1994) as a method to test the existence of housing bubbles. Section IV briefly talks about the dataset used in this paper. Section V presents the empirical results derived from the regime-switching model. Section VI shows Chinese cities with a potential speculative bubble by tracing the movement of Ordinary Least Square residuals over time.

II. Defining a Bubble

Charles Kindleberger defined a bubble as a sharp rise in the price of an asset or a range of assets in a continuous process, with the initial rise generating expectations of further rises and attracting new buyers—generally speculators interested in profits from trading rather than in the use of the asset or its earning capacity.[1]

José Scheinkman and Wei Xiong argued that there are two reasons that lead to speculation. The first is investors' overconfidence, which makes them believe that they are able to sell the assets to other people who are more optimistic and will accept a higher price in the future. Second, due to heterogeneous expectations about future prices, as well as heterogeneous interpretations of information, generates trade among investors. Based on the heterogeneous expectations about price and resale of the goods at higher prices, they define a bubble as the difference between the market price of an asset and its fundamental valuation.[2]

Researchers often focus on specific aspects of this general concept: rapidly rising prices[3]; unrealistic expectations of future price increases[4]; the departure of prices from fundamental valuation.[5] All of these above definitions are similar. In this paper, in order to quantify the bubble, we use the definition proposed by Summers[6] in his fads model. The technique Summers (1986) adopted in his fads model to define a bubble is decomposing the housing price into fundamental and non-fundamental components:

$$\mathrm{P}_t \text{is} = \mathrm{P}_t^{\mathrm{f}} + \mathrm{P}_t^{\mathrm{nf}} \tag{1}$$

P_t is the nominal price of house at time *t*; $\mathrm{P}_t^{\mathrm{f}}$ is called the fundamental price of house, which is determined by both supply and demand of an efficient housing market; $\mathrm{P}_t^{\mathrm{nf}}$ is called the non-fundamental price of house, and equal to the size of the bubble.

III. Testing for a Bubble

Before we talk about the techniques of identifying the housing bubble, we have to state the difficulties of

1 Kindleberger, Charles (1987) *"Bubbles, The New Palgrave: A Dictionary of Economics", John Eatwell, Murray Milgate, and Peter Newman, eds., New York: Stockton Press: 281*

2 José Scheinkman and Wei Xiong (2003), "*Overconfidence and Speculative Bubbles.*"

3 Baker, Dean (2002), *"The Run-Up in Home Prices: A Bubble, Center for Economic and Policy Research, Challenge 46 (6), 93-119."*

4 Case, Karl E and Robert, J Shiller (2003). *"Is There a Bubble in the Housing Market?" An Analysis, Brookings Brookings Papers on Economic Activity (Brookings Institution), 2003:2, 299-342.*

5 Garber Peter (2000), *"Famous First Bubbles: The Fundamentals of Early Manias" Cambridge ,Mass.: MIT Press*

6 Summer (1986), "*Does the stock market rationally reflect fundamental values? The Journal of Finance 61, 591-602*"

calculating a bubble based on its definition from Equation 1. In Equation 1, P_t is $= P_t^f + P_t^{nf}$, only P_t is is observable, and both P_t^f and P_t^{nf} are unobservable. In the last few years, there has been considerable academic interest in models of the market price in which price deviates from its fundamental valuation. Two of the main alternatives are the fads model proposed by Summers (1986), and the stochastic bubbles model proposed by Blanchard and Watson[7]. Based on the Blanchard and Watson (1982) model, Van Norden and Schaller (1994) extend the stochastic bubbles model into a regime-switching model to show that stochastic bubbles can lead to regime-switching in market return by distinguishing fads and bubbles. Monte Carlo evidence produced by Van Norden and Vigfusson[8] has shown that the regime-switching tests have better finite sample properties than stationary tests commonly used in the literature. In another Monte Carlo study, Evans[9] has shown that stationary tests over-reject the presence of a bubble even when a bubble exists by construction.

In the following part of this section, we will first introduce how Van Norden and Schaller (1994)'s fads-bubble regime switching model works to test the movement of the non-fundamental housing price. After this, we move to the selection of a non-fundamental price proxy, we discuss why the ordinary least square residuals are flawed to serve as a non-fundamental price proxy, and after that we talk about the candidates we choose as non-fundamental price proxies in this paper.

A. The regime-switching model

As already defined in section II, we decompose the housing price into fundamental and non-fundamental price (see Equation 1). Applying the assumption proposed by Summers (1986), the fundamental housing price follows a random walk.

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[7] Blanchard O.J. and M.W. Watson (1982),*"Bubbles, rational expectations and financial markets, in P. Wachteled, Crises in the economic and financial structure (Lexington Books, Lexington, MA)"*

[8] Van Norden, Simon and Huntley Schaller (1992), *"Speculative Behavior, Regime-Switching, and Stock Market Fundamental"*

[9] Evans, G. (1991), *"Pitfalls in testing for explosive bubbles in asset prices, The American Economic Review 4, 922-30"*

$$P_t^{f} = P_{t-1}^{f} + e_t, \quad e_t \sim idd(0, \sigma_e^2) \tag{2}$$

Under the fads housing market, the non-fundamental price is an AR(1) process:

$$P_t^{nf} = \rho P_{t-1}^{nf} + v_t, \quad v_t \sim idd(0, \sigma_v^2) 0 < \rho < 1 \tag{3}$$

As we mentioned above, both P_t^{f} and P_t^{nf} are unobservable, and there is no universally accepted proxy of fundamentals that can fully explain the fundamental value; therefore for any proxy of fundamentals, we incorporate an error term.

$$P_t^{p} = P_t^{f} + u_t, \quad u_t \sim idd(0, \sigma_u^2) \tag{4}$$

where P_t^{p} is any proxy of fundamental price and u_t is the measure error. Combining (1) to (4), we can get

$$P_{t+1} - P_t = \beta_1 (P_t - P_t^{p}) + \varepsilon_t, \quad \varepsilon_t \sim idd(0, \sigma_\varepsilon^2) \tag{5}$$

Equation (5) relates the asset returns to difference between the actual price and the proxy for fundamentals. We can rewrite equation (5) as:

$$R_t = \beta_0 + \beta_1 P_{t-1}^{nf} + \tau_t, \quad \tau_t \sim idd(0, \sigma_\tau^2) \tag{6}$$

here, R_t is the return from housing investment.

Assuming the error term τ_t is heteroskedastic, Van Norden and Schaller (1994) nest their fads model within a general regime-switching model and further assume that there are two states of nature, one a high variance (bad, bubble) state, B, and the other a low variance (good, fad) state, F. In particular, suppose that the heteroskedasticity is of the following form:

$\tau_t \sim idd(0, \sigma_F^2)$ with a probability of q

(7)

$\tau_t \sim idd(0, \sigma_B^2)$ with a probability of $1 - q$

where $\sigma_B^2 > \sigma_F^2$. The probability of the bubble surviving, q is bounded to 0 and 1 using the following Logit function:

$$q = \varphi(\beta_{q0}) \quad (8)$$

In equation (8) φ is the logistic cumulative distribution function and β_{q0} is the mean of the logistic distribution function. Thus the regime-switching fad's model can be summarized as (8) and:

$E_t(R_{t+1}|F) = \beta_0 + \beta_1 P_t^{nf}$ (9)

and

$E_t(R_{t+1}|B) = \beta_0 + \beta_1 P_t^{nf}$(10)

Consider an alternative model of non-fundamental house price behavior. This model also satisfies asset-price models.

$$P_t^{nf} = \alpha E_t(P_{t+1}^{nf}) \quad 0 < \alpha < 1 \tag{11}$$

Van Norden and Schaller also assume the probability of the efficient market falls as P_t^{nf}grows. Thus

$$q = q(P_t^{nf}), \quad \frac{\partial q(P_t^{nf})}{\partial |P_t^{nf}|} < 0 \tag{12}$$

They allow for negative bubbles and thus the expected value of the bubble over all states of nature is:

$$E_t(P_t^{nf}) = \left(1 - q(P_t^{nf})\right) \times E_t(P_{t+1}^{nf}|B) + q(P_t^{nf}) \times E_t(P_{t+1}^{nf}|F) \tag{13}$$

Regarding bubble growth, because the government or financial institutions can intervene to stop the rapid growth of a bubble, they assume the bubble is expected to be regulated in State B

$$E_t(P_{t+1}^{nf}|B) = g(P_t^{nf}) \tag{14}$$

Where $g(\cdot)$ is a continuous and everywhere differentiable function, and $0 < g' < 1, g(0) = 0$. Using equation (11)-(14) the expected value of the non-fundamental price in state F is given by

$$E_t(P_{t+1}^{nf}|F) = \frac{P_t^{nf}}{\alpha q(P_t^{nf})} - \left(\frac{1-q(P_t^{nf})}{q(P_t^{nf})} \times g(P_t^{nf})\right) \tag{15}$$

Combing equation (9),(10),(14) and (15), we conclude

$$E_t(R_{t+1}|B) = g(P_t^{nf}) - \frac{P_t^{nf}}{\alpha} \tag{16}$$

and

$$E_t(R_{t+1}|F) = \left(\frac{1-q(P_t^{nf})}{\alpha q(P_t^{nf})} \times (P_t^{nf} - \alpha g(P_t^{nf}))\right) \tag{17}$$

As we assume that $g(\cdot)$ is a continuous and everywhere differentiable function, according to Taylor series expansion Theory (see Appendix A), we can approximate (16) and (17) as the regime-switching model as the following equations:

$$E_t(R_{t+1}|F) = \beta_{f0} + \beta_{f1}P_t^{nf}, \tag{18}$$

$$E_t(R_{t+1}|B) = \beta_{b0} + \beta_{b1}P_t^{nf}, \tag{19}$$

and

$$\text{Prob}(\text{State}_{t+1} = F) = q\left(P_t^{nf}\right) = \varphi(\beta_{q0} + \beta_{q1}(P_t^{nf})^2) \tag{20}$$

The fad model restrictions can be summarized as follows:

$$\beta_{f0} = \beta_{b0} = \beta_0 \tag{21}$$

$$\beta_{f1} = \beta_{b1} = \beta_1 \tag{22}$$

$$\beta_{q1} = 0 \tag{23}$$

The bubble model for the general switching regression can be summarized as follows:

$$\beta_{f0} \neq \beta_{b0} \tag{24}$$

$$\beta_{f1} > \beta_{b1} \tag{25}$$

$$\beta_{q1} > 0 \tag{26}$$

So far we have introduced Van Norden and Schaller (1994)'s fad and bubble regime-switching model, and the six parameters in Equations (18), (19) and (20) are the parameters we have to estimate. The above model serves as a testable model for the movement of non-fundamental price in housing market.

The way to test whether the regime has switched from fad to bubble is to see whether the six parameters meet the fad model restrictions (Equations (21), (22) and (23)). Because the fad model implies certain restrictions (Equations (21), (22) and (23)) on the general switching model, these restrictions are inconsistent with the bubble model condition, so if we fail to reject them, we would conclude there is no significant evidence that the regime has switched to the bubble model.

Although the regime switching model offers us a testable method and tells us we can regress the return of housing investment on the non-fundamental price to diagnose the housing market, neither the fundamental housing price nor the non-fundamental housing is observable. Now a new question must be addressed: how can we choose a reasonable proxy of non-fundamental price?

B. Flawed Ordinary Least Square residuals as a non-fundamental price proxy

Researchers have created a multiple regression model to estimate the existence of a bubble; their method is basically regressing the housing price on several pricing-determined variables such as population density, mortgage interest rate, income, and GDP growth. The amount by which actual market price deviates from the prices predicted by the multiple regression model is interpreted as the extent to which the housing valuation is overpriced or underpriced. Their argument is that because the fundamental price P_t^f can be well explained by those explanatory variables, then the estimated residuals closely match the non-fundamental price ($P_t^{nf} = P_t - P_t^f$). However, the way OLS (ordinary least squares) estimates the coefficients is always based on the assumption of an error term with mean value of zero. Even in the cases where a bubble does not actually exist in any observations, OLS will always return the result that several observations are overpriced and others are underpriced. In addition, this method assumes that past housing price were determined by fundamental factors with a random error term, so any systematic deviations of current prices from the values predicted by the model must be because current prices have wandered away from fundamental values. However, if current market prices are higher than the value predicted by multiple regression models, it may be because the past prices were consistently below fundamental price.

C. Proxies of non-fundamental house prices

In academia, there has not been a universal consensus on fundamental price and non-fundamental price proxy. In this section, we estimate two possible measures for the non-fundamental house price. Misspecifying either the level or the scale of the non-fundamental house price will have no effect on the regime-switching tests, as the coefficient restrictions and likelihood ratio tests are invariant to linear transformations. Thus, what is required is an estimate that is highly correlated with the true non-fundamental house price.

The first measure we choose is based on the results of José Scheinkman and Wei Xiong's (2003) speculation model, which we label Method A. Harrison and Kreps[10] first proposed a speculation model where heterogeneous beliefs generate a non-fundamental price component equal to the option value for resale. Scheinkman and Wei Xiong (2003) developed the stochastic bubbles model proposed by Blanchard and Watson (1982) into a speculation model, and they found that there is a monotonically increasing relationship between the size of bubble and the turnover, and bubbles are accompanied by large trading volume and high price volatility. The monotonic relationship indicates turnover can be used as a suitable non-fundamental proxy.

The second measure we use is based on a standard asset-pricing model. The fundamental price of an asset is equal to the present discounted value of future dividends. Meese and Wallace[11] suggest that the rent on housing can be taken as a dividend. Thus, our second measure of non-fundamental housing prices is the real housing price minus the mean price-rent ratio times the real rent, and this method is labeled as Method B.

IV. Data

The dataset used in this paper includes nine years of data from 1999 to 2007 for 35 of China's largest cities (see appendix A). Data on housing price index, rent index and CPI, were collected from Chinese Statistical Yearbooks (2000-2008). GDP, income per person, mortgage loans, mortgages loaned by real estate firms, real estate investment, fixed asset investments and non-agricultural population were collected from China Data Online. Average housing price per square meter, floor space of residential buildings actually sold by use, floor space of

[10] Harrison, Michael and David Kreps (1978), *"Speculative investor behavior in a stock market with heterogeneous expectations, Q.J.E. 92, 323-336"*

[11] Meese, R. and N. Wallace (1990) *"Determinants of residential housing prices in the bay area 1970-1988: effects of fundamental economic factors or speculative bubbles, mimeo"*

residential buildings under construction, floor space of residential buildings completed and turnover were collected from China Real Estate Statistics Yearbooks (2000-2008). Short-term mortgage loan rates and long-term mortgage loan rates were collected from the China Central Bank website.

V. Empirical evidence

In this section, we use fixed effects to see what factors caused the rise of China's housing price. After this we diagnose whether a bubble exists in various Chinese cities' housing markets.

A. Fixed Effects Regression

$$P_{it} = \beta_0 + \sum_{t=1}^{m} \mathrm{Year}_t + \sum_{k=1}^{n} \beta_i x_{itk} + \alpha_i + u_{it}$$

where α_i is the city-level fixed effects. As we are dealing with panel data, we have to include fixed effects and time dummies into our regression. Time dummies will take out any time trend and fixed effects will remove any unobserved fixed characteristics unique to each city and further solve the problem of omitted variable bias and make the estimated coefficient the best linear, unbiased estimator.

Two fixed effects regression models were employed (see the Appendix A--Model A). We found that GDP, total mortgage loans, the square of total mortgage loans and the mortgages loaned by real estate firms are the main reasons behind the continuous increase of housing price. Further we ran a random effects model and used the Hausman Test to determine whether the coefficients of fixed effects and random effects are significantly different. The Hausman test results tell us that they are statistically different, so we must utilize the fixed effects estimators. We further use Newey-West standard errors and robust standard errors to correct the efficiency problem caused by autocorrelation and heteroskedasticy (see Appendix A).

B. Causal Identification of Control Variables

GDP: During the last ten years, China's GDP has grown rapidly, and per capita income has gone up each year. As income per person rises, more and more people have the ability to purchase a house or apartment. This drives up demand in the housing market and subsequently also drives up the price. Furthermore, the rapid development of China's economy leads more and more people to demand high-quality housing structures and a good community environment.

Loans: Different from other industries, the abundant liquidity of both the housing buyer and real estate companies is the basis for the growth of real estate market. This matches the significance of total loans with a positive coefficient.

Housing Built: The results of the regression show that the floor space of residential buildings completed is significant with a negative coefficient; this rules out a simple supply side story in which a sudden decrease in housing supply or rational expectations of future supply decreases caused the surging housing price.

C. Diagnosing the Housing Bubble

We estimate the switching-regression model (Equations (18) through (20)) using data on excess returns of each city during 1999-2007 and the two non-fundamental housing prices we discussed above. The table in Appendix B presents the coefficient estimates and their associated t-statistics, as well as the p-value of likelihood ratio test. Also we use the likelihood ratio test to test the bubble model against the fad model with constant probability and variable probability of partial collapse. The results match more on the bubble model. The slope coefficients in Equations (18) and (19) are significant in all cases, and the interpretation is that the non-fundamental price has significant influence on the excess return.

VI. Where is the bubble?

From the former section, we have found some evidence that a bubble does exist in China's housing market. As we mentioned in Section III B, Ordinary Least Squares residuals are flawed to be a non-fundamental price proxy, but once we find evidence of the bubble's existence, the residuals predicted by OLS can show us how actual prices deviate from their fundamental valuation. In this section, we introduce the argument that many Chinese economists have made that China's housing bubble started around 2004. Under this assumption, we need to investigate how the regression residuals vary over time.

The method used to investigate the trend of the residuals is to first use fixed effects regression on the data of 1999-2003 to look for the factors that have caused the change of the housing price, after this we calculated the predicted value of 2004-2007 by using the fixed effects regression model we find to compare the difference of actual price with the predicted price. However one problem is apparent: we cannot put year dummies into our fixed effects model because we are using the data from 1999-2003 to estimate the parameters and using the data from 2004-2007 to predict the price. If we add year dummies (1999-2003), the predicted value will lose time trends. In this case, if year dummies have positive coefficients, our predicted value from 2004 to 2007 will be biased towards zero. In this part, we assume the year trends of all these nine years are the same by adding a time variable t=(1, 2, 3, 4, 5, 6, 7, 8, 9) to take the time trend into account.

We find the factors that affect 1999-2003's housing price are income per person and foreign investment (See Appendix A, model E). Considering China's unbalanced economic development, we divide these 35 cities into two regions: coastal/Yangtze River Delta (hereafter referred to as "coastal"), and inland regions. For coastal cities, Figure B1 shows the evidence of the existence of a housing bubble, because the actual price is substantially higher than the predicted price and the gap between them explode over time. However, for the inland region, the evidence is insufficient to prove the existence of bubble (see Figure C2). Further calculations on the difference of actual price and predicted price of each city show us evidence that the bubble exists in some cities, especially coastal cities which can be seen graphically in Figures D, E and F.

VII. Conclusion

The objective of this paper is to test whether a bubble exists in China's housing market; the technique we employed is the regime switching model. In Section V, the result of the regime switching regression indicates that there is some evidence of speculative bubble in house prices in China. In section VI, we traced the change of difference between actual and predicted value of each city, and Figures B and C are consistent with the results in Appendix B. A pressing question that has real-world implications now must be considered: when will the bubble burst? In the econometrics time-series world, short term forecasting has been an extremely difficult job. Attempting short term forecasting the trend of housing price is similar to the case of leaving a cup of boiling water in a room with constant temperature 20 degrees Celsius and trying to forecast the temperature of the water over time. We can be sure in some extent that after a certain period the temperature will eventually become the room temperature, which is 20 degree Celsius, but we fail to forecast what the temperature is at each moment before the temperature of the water drops to 20 degree Celsius. Any temporary unanticipated shocks will substantially affect the temperature-trend in short period, but have negligible effect in long run. This example indicates how considering the unpredicted macro-policy and consumer's behavior and expectation on housing price, forecasting the time that the bubble will pop is not convincing, but it implies we can make a rough forecast for the housing prices in the long run.

From the demand side, consumers purchase housing for mainly three reasons: housing value, investment and speculation. Only those consumers who buy housing for its value are the rigid (inelastic) consumers in the long run housing market, and therefore the size of this group will determine the long-run trend of housing price. Many surveys on housing market have shown us that the rigid housing consumers in China's housing market are young people that are about to get married; it means that in the next twenty years, youth born after 1990 will become the rigid consumers in China's housing market. Figure F shows us that the population born after 1990 has declined over time, and this provides us some evidence that the trend of housing price over the next 20 years will be declining. The way that a successful model works is based on some assumptions which prove to be false, but in such a way that the final results are not sensitive to these discrepancies. However, as we mention in Section III, the non-fundamental housing price is unobserved and using time series data to make forecasts has to include a white noise error term, which is totally randomized. Thus using quantitative methods to forecast the date of housing bubble burst is unreliable. Obstfelf and Rogoff said: “the only accurate way we can predict the time that bubble will burst is after it has burst.”

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Appendix A

	Model A	Model B	Model C	Model D		Model E
VARIABLES	price	Price	Price	Price		Price
GDP	0.549***	0.544***	0.544**	0.544**	foreign investment	2.102***
	-0.099	-0.093	-0.229	-0.211		-0.575
total mortgage loan	0.253***	0.307***	0.215**	0.215**	Time	130.520***
	-0.096	-0.087	-0.1	-0.096		-17.188
total_loan_square	-0.000***	-0.000***			non agricultural population	-2.816**
	0	0				-1.252
floor space of residential building completed	-1.157***	-1.227***	-1.101***	-1.101***	Constant	2,681.060***
	-0.188	-0.173	-0.384	-0.314		-317.555
mortgage loan by real estate sectors	4.358***	5.095***				
	-1.088	-1.052				
Constant	1,670.484***	1,617.406***	1,777.631***	3,234.506***		
	-134.582	-157.662	-97.343	-521.168		
Observations	309	309	315	315		175
R-squared	0.82		0.811			35
Number of id	35	35	35			0.518
Rmse	480.4	485.4	465.4			192.3

Hausman test chi2(11)= 23.83

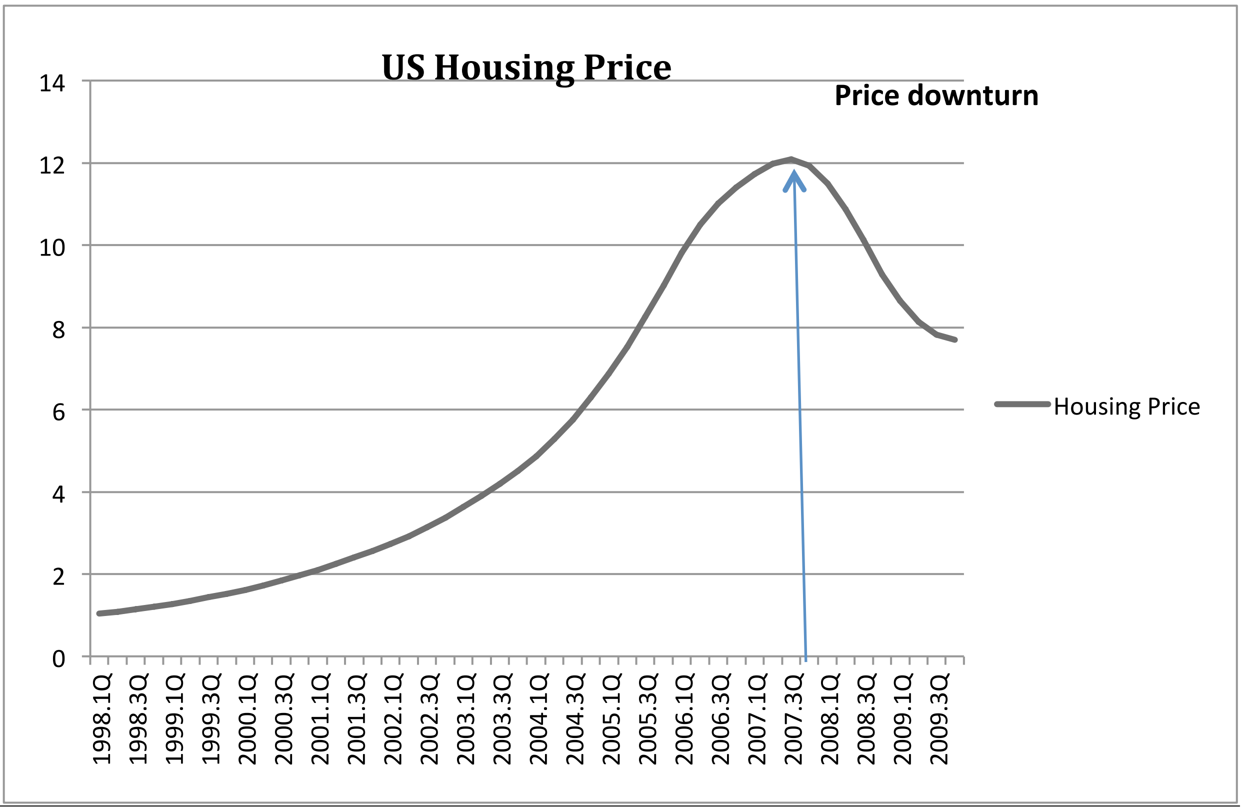
Prob>chi2 =0.0135

Note: Year dummies are added

Appendix B

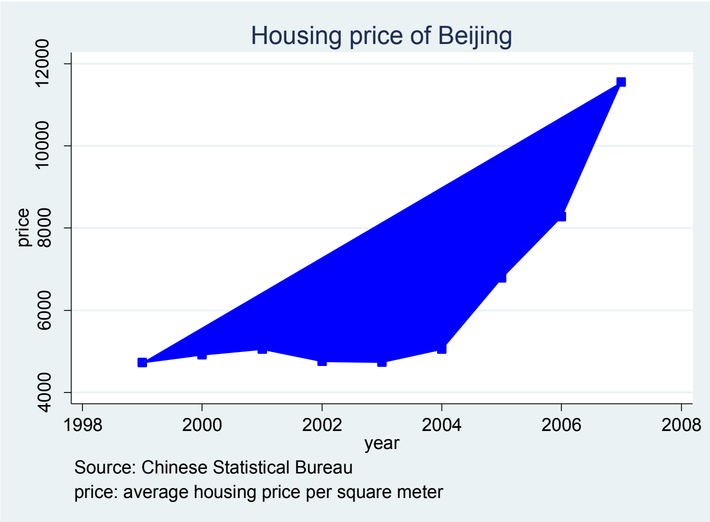
Regression Switching Model Regression Results		
Model of fundamentals	Model A	Model B
Parameter estimates		
beta-f0	0.0210	0.0120
	0.0004	0.0003
beta-b0	0.0003	-0.0006
	0.5230	0.3980
beta-f1	0.0460	0.0330
	0.0000	0.0001
beta-b1	0.0010	0.0230
	0.0000	0.0000
beta-q0	2.3140	2.1580
	0.0000	0.0000
beta-q1	3.6980	-1.7990
	0.1830	0.1350
likelihood ratio tests	p-value	
Bubble model with constant probability	0.1150	0.0110
Fads model with variable probability	0.0030	0.0120
Fads model with constant probability	0.0020	0.0091

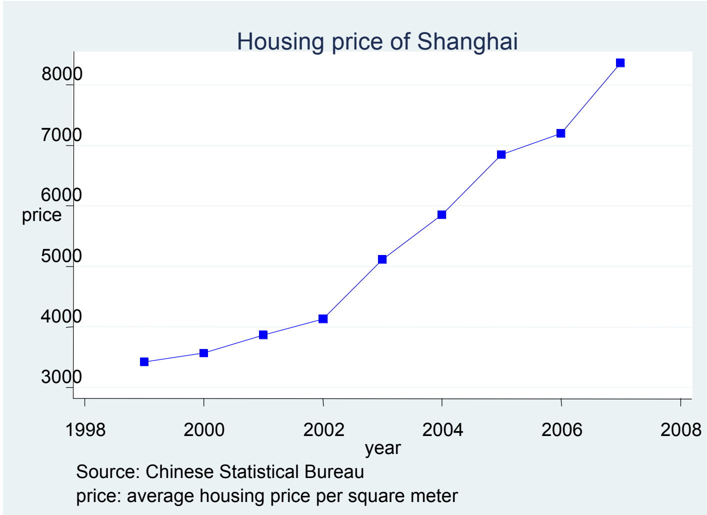
Figure A

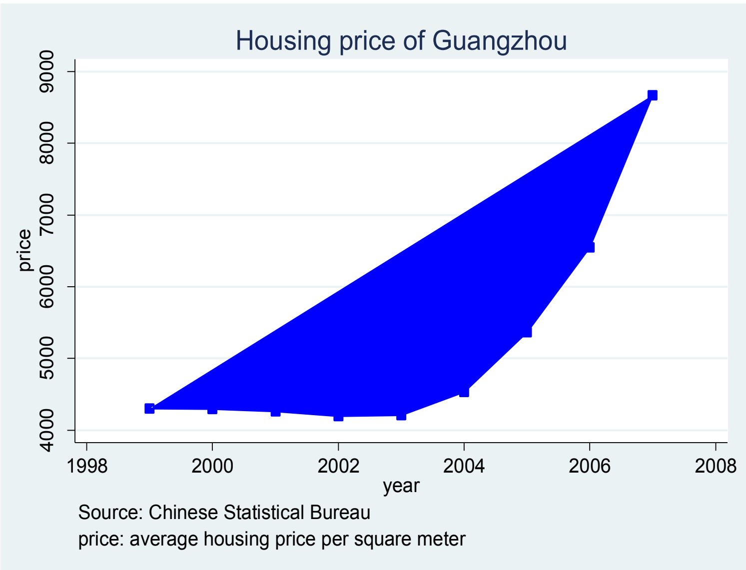


Source: US Federal Housing Finance Agency

Figure B


Housing price of Beijing
price
4000
6000
8000
10000
12000
1998
2000
2002
2004
2006
2008
year
Source: Chinese Statistical Bureau
price: average housing price per square meter


Housing price of Shanghai
price
3000
4000
5000
6000
7000
8000
1998
2000
2002
2004
2006
2008
year
Source: Chinese Statistical Bureau
price: average housing price per square meter


Housing price of Guangzhou
price
4000
5000
6000
7000
8000
9000
1998
2000
2002
2004
2006
2008
year
Source: Chinese Statistical Bureau
price: average housing price per square meter

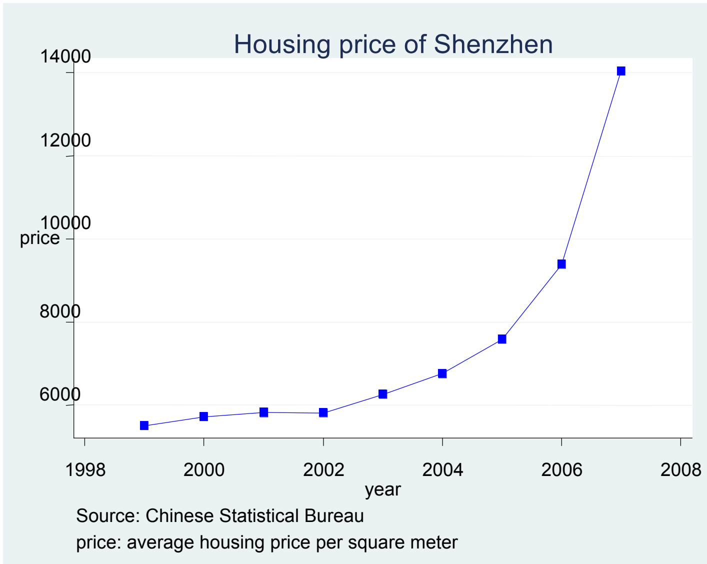
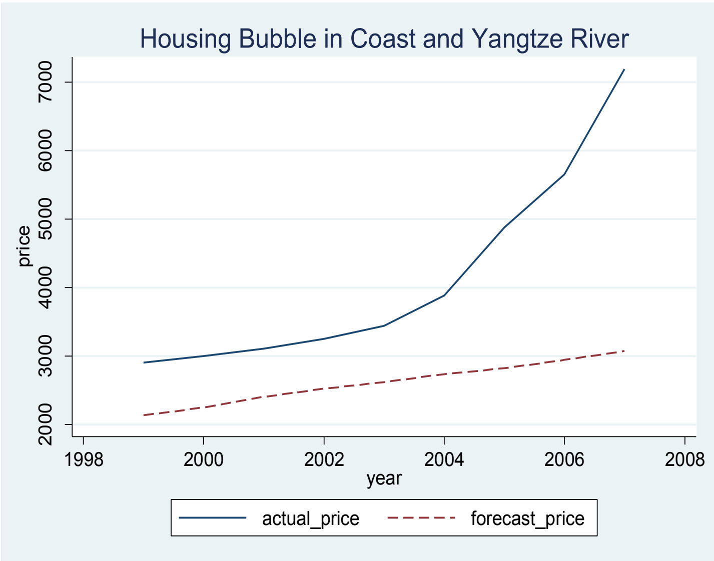
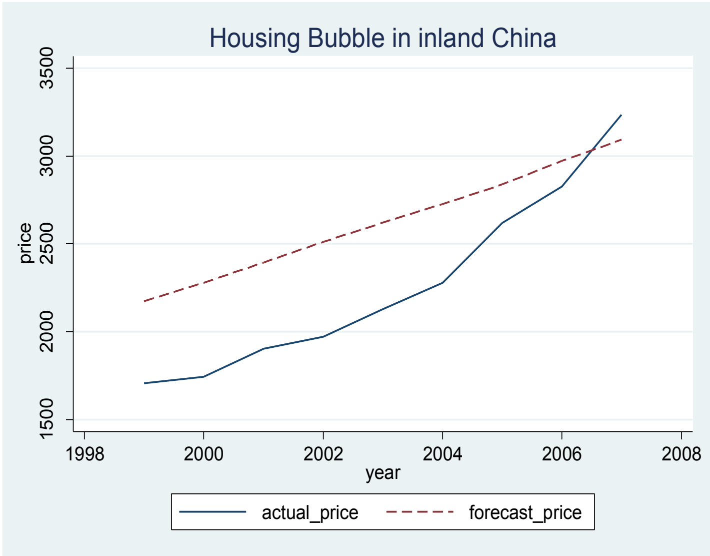

Housing price of Shenzhen
price
6000
8000
10000
12000
14000
1998
2000
2002
2004
2006
2008
year
Source: Chinese Statistical Bureau
price: average housing price per square meter

Figure C

1



2



Note:

1. The average actual housing price and the average forecast price in Coastal and Yangtze River Delta regions
2. The average actual housing price and the average forecast price in inland regions

Figure D

Difference of actual price and forecast price in some Chinese cities

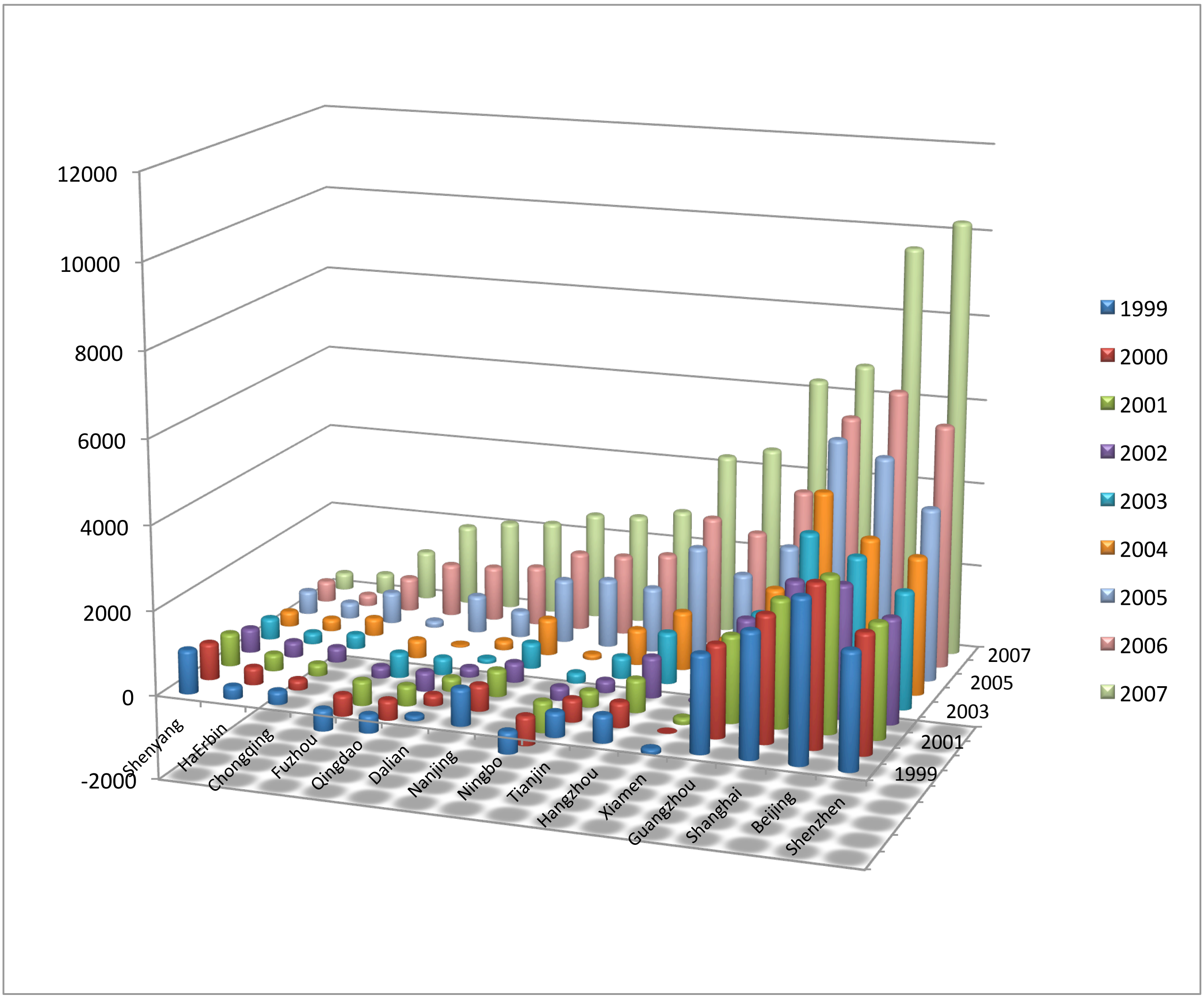
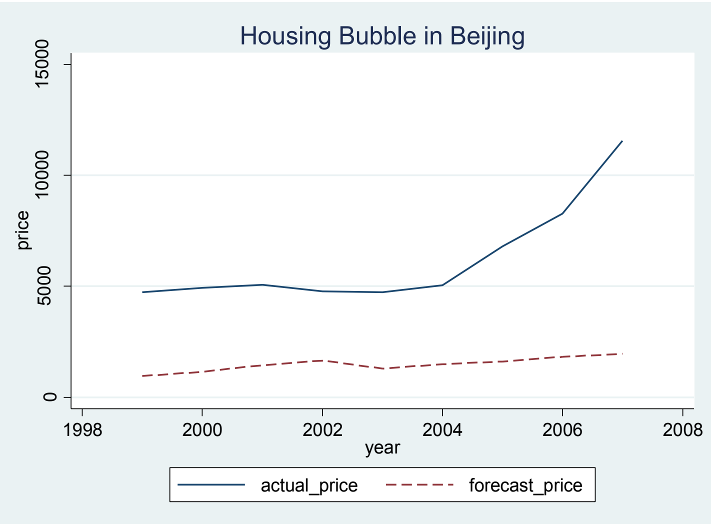


Figure E

1



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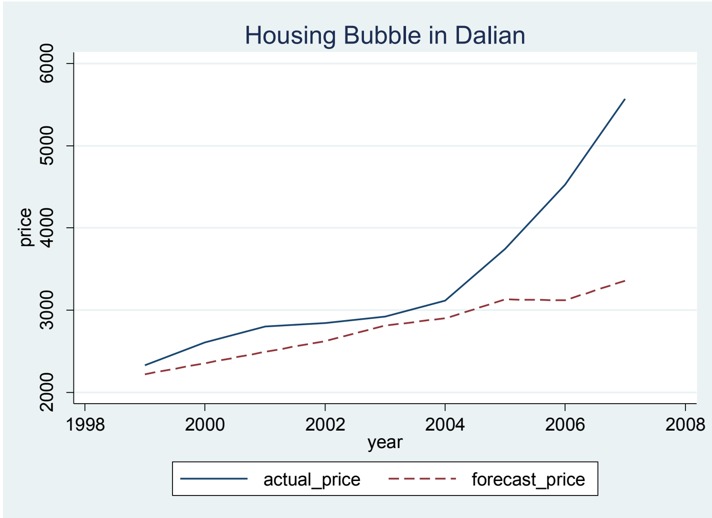
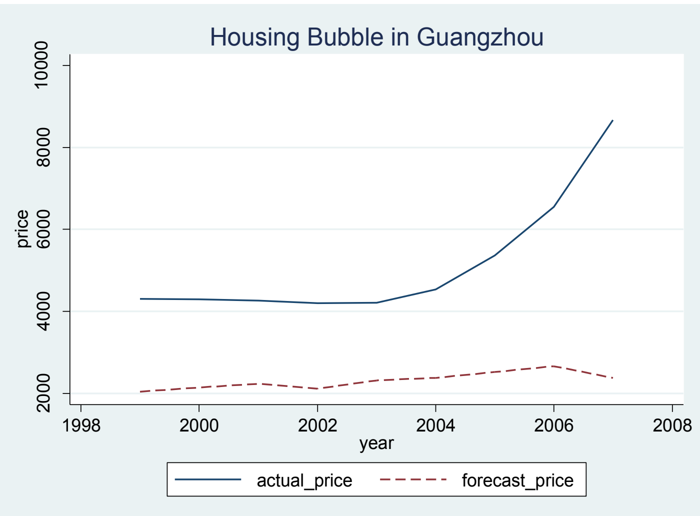
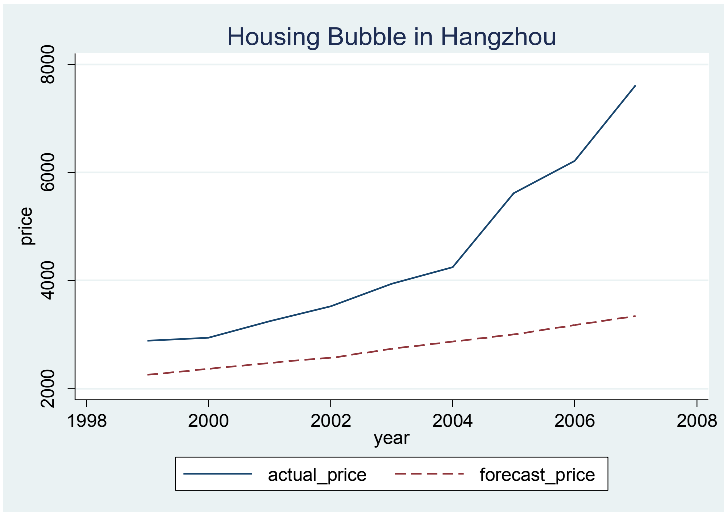


3



4

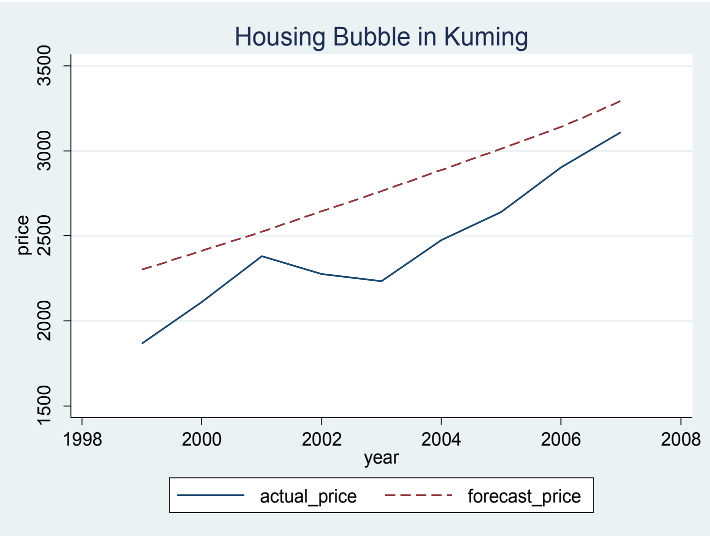


Note:

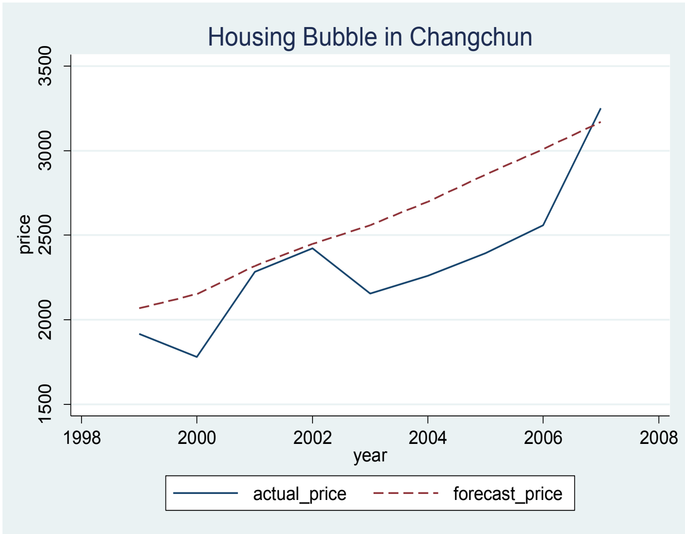
1. Beijing: national capital, northern coastal city
2. Dalian: a northeast coastal city
3. Guangzhou: a southeast coastal city
4. Hangzhou: a city located in Yangtze River Delta

Figure F

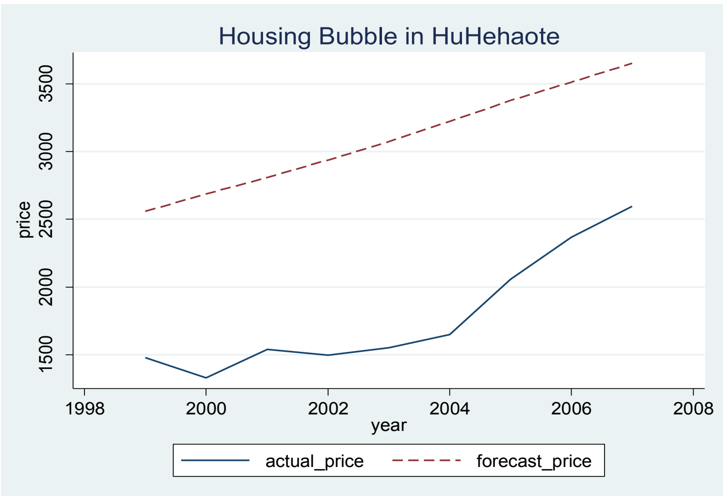
1



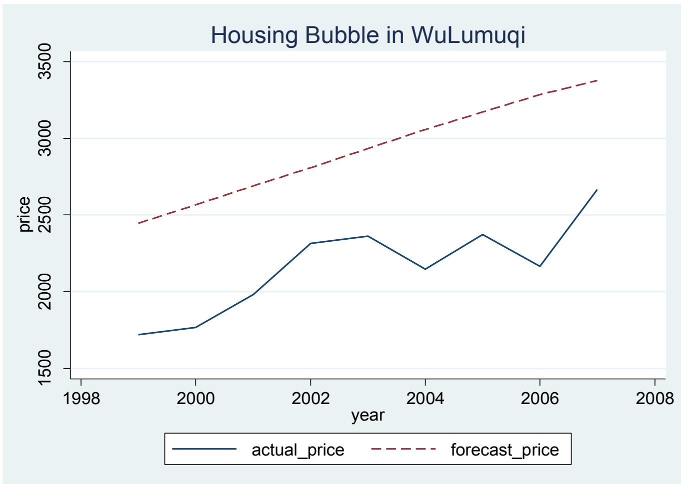
2



3



4

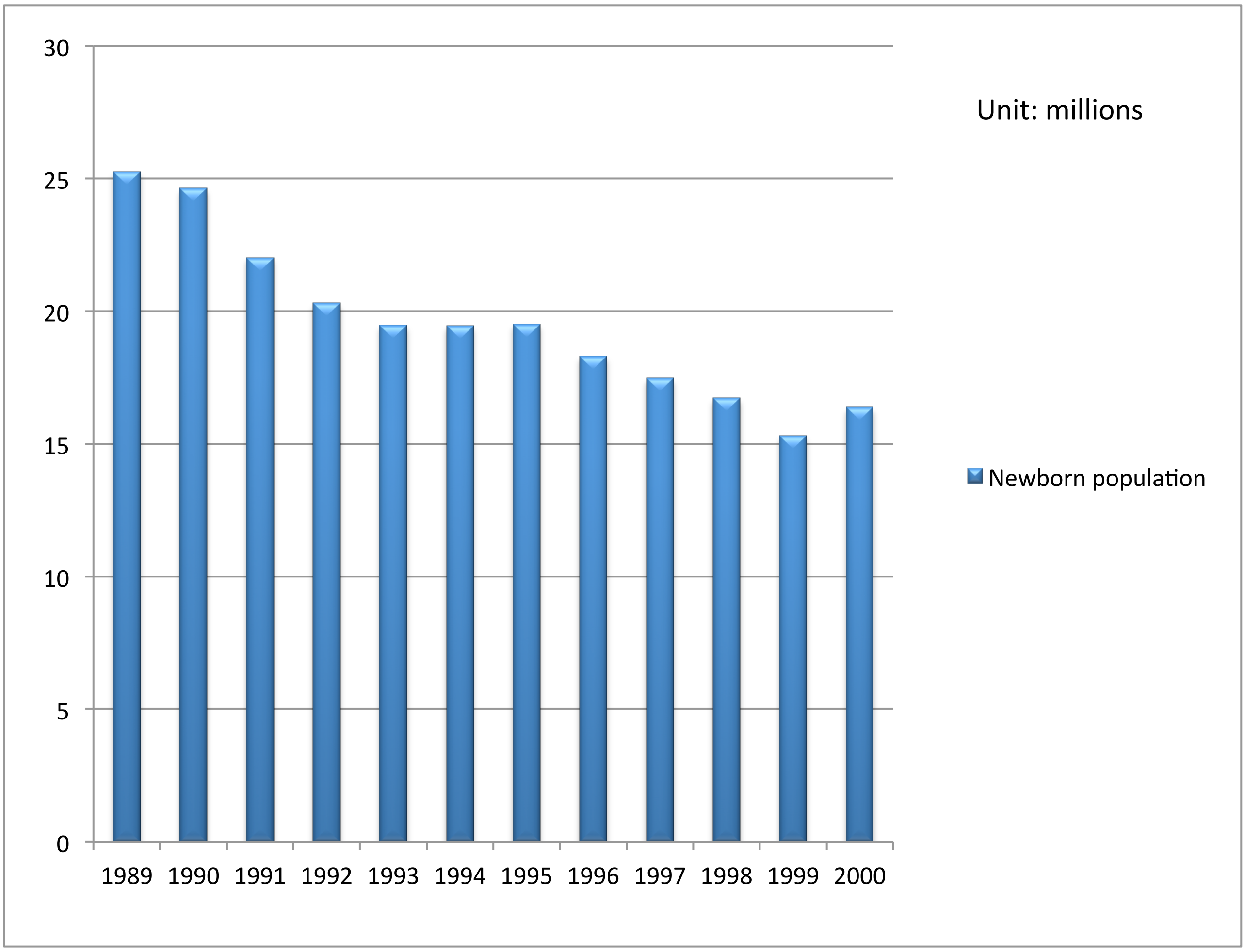


Note:

1. Kunming: a southwest inland city
2. Changchun: a northeast inland city
3. Huheahote (Hohhot): a northern inland city
4. Wulumuqi (Urumqi): a northwest city

Figure G

Newborn Population After 1989



Source: Population Census