Chapter 4

Empirical Results

4.1 Characterizing House Price Factors Influencing

To investigate the characteristics of the impact factors of China's house price, this paper follow the Jud and Winkler (2002) approach as described in section3.4.

4.1.1 The Results of Unit Tests

First, this paper determined the order of integration of the effect of factor variables. If they are I(1), then this paper can test the existence of the long-term relationship between them, that is, whether or not they are cointegrated.

The tests for stationary are in Table 4.1. The Levin, Lin and Chu (2002) method test indicates that LNHP, LNPPI, LNGDP and LNLP are significance level to accept null of a unit root. The Breitung (2000) method test indicates that LNHP, LNPPI, LNGDP and LNLP are significance level to reject null of a unit root. The Im, Pesaran and Shin (2003) method test indicates that LNHP, LNPPI, LNGDP and LNLP have a unit root. ADF-fisher Chi-square (1999) method test indicates that LNHP, LNPPI, LNGDP and LNLP are significance level to reject null of a unit root. PP-Fisher Chi-square (2001) method test indicates that LNPPI, LNGDP and LNLP are significance level for reject null of a unit root but LNHP has unit root. The results of panel unit root test cannot obtain a conclusion that all variables used in this model have unit root or all variables do not have not unit root. So all variables should take first difference or take second difference and when taking first difference in all variables the results of panel unit root test is based on 4 methods. The Levin, Lin and Chu (2002) method test indicated that LNHP, LNPPI, LNGDP and LNLP are significance level to reject null of a unit root. The Breitung (2000) method test indicates that LNHP, LNPPI and LNGDP are significance level to reject null of a unit root but LNHP has unit root. The Im, Pesaran and Shin (2003) method test indicate that LNHP, LNPPI, LNGDP and LNLP are significance level for reject null of a unit root. ADF-fisher Chi-square(1999) method test indicate that LNHP, LNPPI, LNGDP

and LNLP are significance level for reject null of a unit root. PP-fisher Chi-square (2001) method test indicate that LNHP, LNPPI, LNGDP and LNLP have unit root. Finally when take first differing in all variables then clearly that almost all statistics confirmed that the variables are I (1), which indicates that they are not stationary. As the bank's mortgage interest rate is determined by the central bank, the interest mortgage rates of all cities are the same at the same time. The graph of the interest mortgage rate exogenous variable show that is none trend (see Figure 4.1). So interest mortgage rate only used the panel unit root test of LLC, ADF-fisher Chi-square and PP-fisher Choi Z-stat (table 4.2). LNI is significance level for accept null of a null of a unit root, but LNI is reject null of a unit root when take first differences.

4.1.2 The Result of Panel Cointegration Test

Table 4.3 presents the panel cointegration statistics. Two kinds of statistics, panel and group, were used to observe the relationship between series. The first four test statistics are based on the “within” dimension (panel statistics). If the null is rejected, among of each data has panel cointegration for all cites. The last three test statistics are based on the “between” dimension (group statistics). In this case, cointegration among variables exists for at least one of the all cites. Table 4.3 shows that group statistics are more significant than panel statistics, which means house prices and effect factors cointegrating in at least one of the cities is more predominant. The statistics based on ADF test and PP test presents the evidence that house prices and explanatory variables are cointegrated, as both panel and group statistics are significant. Moreover, table 4.4 present the result of Kao residual cointegration test base on ADF statistics, ADF statistic indicate that all variables used in this model are significant at the rejection of the null hypothesis at the 0.01 level of significance. This means that the movement of house prices in urban real estate price market in China is connected with that of the GDP, per capita disposable income, interest rate and land price. However, the results in Table 4.3 are inconsistent; some statistics are significant, while others are not. As the data used in this paper are panel data, the diverse results or evidence can be caused by the different relationships between house price and effect factors in the twenty-one cities.

4.1.3 The Result of Hausman Test

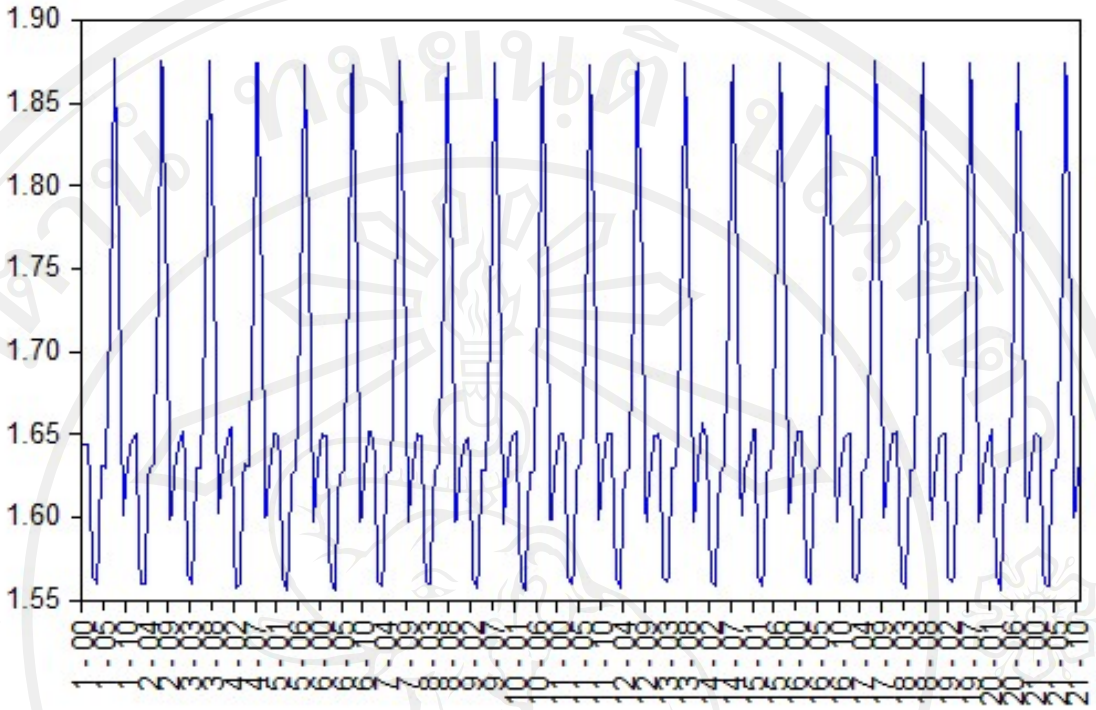
A critical assumption in the Error Component Panel Data Regression model is that the remainder stochastic disturbance term is not correlated with independent variables. If the remainder stochastic disturbance term and independent variables are correlated, the random effects estimator becomes biased and inconsistent, but the fixed effect estimator is still unbiased and consistent. Hausman (1978) suggests a test compares the different probability limits of random effects estimator with fixed effects estimator as the selection criteria for random effect estimator and fixed effect estimator.

Panel cointegration model estimator makes have made the choice between the random effects and fixed effect estimators based upon the standard Hausman test. If this standard Hausman test rejects the null hypothesis that the conditional mean of the disturbances given the regressors is zero, the paper reports the fixed effects estimator. Otherwise, the paper reports the random effects estimator. Here, the result of Hausman test present in table 4.5. The Hausman test $\chi 2$-statistic is 35.364479, which is significant under the 1% level. It indicates that the random effects estimator is inconsistent, so we choose fix effects estimator for Eq. (28).

Table4.1: Results of Panel Unit Root Tests Based on 4 Method Tests for Variables

Method	Housing price(lnHP)		Income(lnPPI)		lnGDP		land price(lnLP)	
	Levels	1th-differences	Levels	1th-differenc	Levels	1th-differences	Levels	1th-differences
Null Hypothesis: unit root (common unit root process)								
LLC								
Individual effects	0.83479	-6.75024***	-1.63013	-13.1051**	-1.65425**	-7.57520***	1.8708	-10.6604***
Individual effects, individual linear trends	-6.76076***	-8.44582***	-8.14113***	-14.0339***	-3.04285***	-9.66857***	-8.86227***	-10.7376***
None	5.84735	-2.01560**	45.8426	-2.05386**	41.1299	-1.34374	8.94595	-3.19357***
Breitung								
Individual effects, individual linear trends	0.11048	-4.00844***	-0.03203	4.56022***	1.81553	-2.35739***	4.75692	-2.09392**
Null:unit root(individual unit root process)								
IPS								
Individual effects	6.40370	-2.98040***	5.41100	-5.52897***	4.51989	-3.30829***	7.17840	-4.99815***
Individual effects, individual linear trends	-1.09093	-1.31795	-0.17321	-3.29971***	1.50235	-1.56551	-1.56113*	-2.22722**
Maddala and Wu(1999) and Choi(2001)								
ADF-Fisher Chi-square								
Individual effects	10.3175	74.1920***	19.2807	108.181***	21.3038	77.1734***	13.1420	105.078***
Individual effects, individual linear trend	58.3990**	67.9015***	47.3974	96.2305***	31.3245	69.8472***	73.3749***	86.7941***
None	7.91100	39.4237	0.32351	40.2922	1.31670	28.9282	5.52911	57.4299*
PP-Fisher Chi-square								
Individual effects	16.0221	78.5405***	46.7350	107.015***	45.4689	100.271***	27.4906	126.835***
Individual effects, individual linear trends	32.0489	85.2919***	33.4780	125.739***	48.3792	102.703***	87.8636***	120.964***
None	1.04507	35.4015	0.30003	52.6310	0.00423	28.8100	3.78591	62.0175**

***and** denote statistical significance at the 1% and 5%levels,respectively Form: computed



Note: The numbers in front of the bar stand for 21 mall cities respectively. The numbers behind the bar stand for yearly time serial.

Figure4.1 The Log R

Table 4.2: Result of Panel Unit Root Tests for the Variable of Interest Rate

Form:computed

Method	Levels	Differences
LLC-None trend	-0.64378	-17.5445***
ADF-fish Chi-square--None trend	20.6856	235,624***
PP-fisher fish Chi-square--None trend	20.6938	190.641***

*** denote statistical significance at 1% level

Table 4.3: Pedroni Panel Cointegration Test of the House Price and Economic Fundamentals

From:computed

	Panel statistics	**Group statistics**
No deterministic trend		
Variance ratio	-3.032113	
Rho statistics	3.702853	5.571032
PP statistics	-6.529957***	-7.171826***
ADF statistics	-3.926317***	-3.472677***
Deterministic intercept and trend		
Variance ratio	-4.683898	
Rho statistics	5.498969	6.788937
PP statistics	-9.430848***	-13.29691***
ADF statistics	-3.476944***	-4.973705***
No deterministic intercept and trend		
Variance ratio	-3.320761	
Rho statistics	2.585844	5.104502
PP statistics	-2.995211***	-3.933034***
ADF statistics	-3.780778***	-6.956560***

*** denote statistical significance at 1% level

Table 4.4: Result of Panel Cointegration Test of the House Price and Economic Fundamentals based on ADF Statistic (Kao,1999)

Form：computed

Test name	Test statistic	Significance level for rejection of the null hypothesis
Kao test	-6.963081***	0.0000

*** denote statistical significance at 1% level

Table 4.5: The Result of Hausman Test

Form: computed

Test name	Test statistic	Significant level for rejection of the null hypothesis
Hausman test	35.364479***	0.0000

Note: reject null hypothesis indicates that the random effect estimator is inconsistent so that choose fixed effects estimate. *** denote statistical significance at 1% level

4.1.4 The Result of Estimating Panel Cointegration Model

Table 4.6 is the regression result of the fixed effects panel estimator of housing price and economic fundamentals model base on OLS-estimator and DOLS estimator.

In long-run base on OLS-estimator to estimating panel cointegration model suggested that per capital disposable income has positive impact on house price, an increase in per capita disposable income by 1% cause house price to rise by 0.13; a increase in mortgage interest rate by 1% point increase real house price by 0.12 house price are predicted to increase by 0.28 in the response to a 1% increase in gross domestic product. However, the coefficient estimate of land transaction price is smallest. The elasticity of house price to land transaction price is 0.016.

Table 4.6: The Result of the Long-run Relationship of House Price and Economic fundamental

Form: computed

Independent variables	OLS estimator	DOLS estimator
cons	-15.92173*** (-3.436896)	-10.38457*** （-3.196961）
lnPPI	3.007439*** (0.129158)	6.042689*** （0.232356）
lnR	2.428671** (0.122391)	3.273829*** （0.418755）
lnGDP	9.852735*** (0.286339)	2.758877*** （0.052414）
lnLP	3.371361*** (0.016475)	3.386104*** （0.083181）
D(lnPPI-1)		2.529094** （0.566324）
D(lnR-1)		-1.383981 (0.178315)
D(lnGDP-1)		-0.309395 (-0.069156)
D(lnLP-1)		-2.259744** (-0.136748)

Note: *t* values of the estimated coefficients are given in the parentheses, ** and***denotes 5% and 1% significant level respectively

However, base on DOLS-estimator to estimating panel cointegration model. The empirical results imply that in long-run when LNPPI increasing 1% then the house price increasing 0.23. Otherwise, when LNR increasing 1% then the house price increasing 0.23, and when LNGDP increasing 1% then the in house price increasing 0.05, and when LNLP increasing 1% and then the house price increasing 0.08.

Based on the point estimates of the long-run relationship of house price and economic fundamentals, the determination of house price fundamentals the yields results which are largely consistent with the theoretical predictions. Real GDP, real per capita disposable income have positive impact on house price. The results indicate GDP growth and income growth are important driving forces for house price appreciation in China. In the mean land transaction price also play important roles in determining house price equilibrium level. However, the coefficient of real mortgage rates is positive, which conflicts with the theoretical prediction that increases in mortgage rate have dampening effect on house prices in the long run. This coefficient estimate is most likely due to the following two reasons. Firstly, from 2003, China has overheated its economy is relevant real estate industry. For example, fixed asset investment has grown rapidly, the supply of iron and steel, energy and transport is in tight supply, and China has felt the pressure of inflation. Secondly, the growth in mortgage credit increases the financing capacity of households and stimulates the demand for housing. In order to control the growth of the banking credit and house price, the central bank has raised the interest rates and commercial bank deposit reserve ratio several times while at the same time contracting the money supply.

4.2 Detecting Housing Bubble

Mikhed, Petr Zemˇcík(2009) defined the spread between the house price and cash flows as $S_{i,t} \equiv P_{it} - \frac{1}{D} C_{i,t}$ If no-bubble condition holds, S_{it} must be stationary, $S_{it}=0$ $P_{it}/C_{it}=1/D$. The stationary of S_{it} implies that the house price-to-rent ration will be also stationary. Two cases to ascertain whether or not bubble exist. Case1: the price-level is non-stationary while the rent-level is stationary, and Case 2: both series are of first order or second order of integration but price-level and rent-level are not cointegrated.

The research will select China's urban sale price index of real estate and China's urban rental price index of real estate represent respectively the price level (P_{it}) and rent level (C_{it}) at the same period time. To investigate whether there is a long-run equilibrium relationship between house price and rental price corresponding to the present value formula Eq. (29). To do so, Since the less restrictive IPS statistic is based on averaging individual ADF unit root tests and is therefore used in this

research to determine the stationary of data. So only conduct the IPS test for unit roots and the cointegration tests employed in this paper rely on the results of Pedroni (1999, 2004) framework to test for cointegration in this research.

Table 4.7 and 4.8 shows the result during sample period base on unit root test and cointegration tests, as suggested by Mikhed and Zemˇcík (2009). In the table 4.7, the price-level series and rent-level series are non-stationary in the level and first differences, the statistics confirmed that house sale price and house rent price are I(2). So it is necessity of the cointegration test for these two variables, however statistics test are largely accept the null hypothesis of non-cointegration. Table 4.8 presents the evidence that house sale price and house rent price are not cointegration. The result showed that there exists bubble in China's urban real estate market, because the empirical analysis satisfied the case 2 of bubble exist. So there is a risk that property values in large cities are deviating from fundamentals

Table4.7: The IPS Panel Unit Roots Test for Bubble Variables

	level	1st-diference	2st-difference
Sale house price	-0.59748	-1.61110	-1.81945**
Rent house price	1.00138	-1.17760	-2.19987**

Note: The IPS test is based on the individual ADF regressions with an intercept and trend. ** denote significance at the 5% level

Table 4.8: Pedroni Panel Cointegration Test for the Bubble Variables of the Sale House Price and Rent House Price

	Panel statistics	Group statistics
Deterministic intercept and trend		
Variance ration	1.268941	
Rho statistic	2.594763	3.698499
PP statistic	-0.691157	0.405775
ADF statistic	-2.642466***	-2.970171***

*** denote statistical significance at 1% level

4.3 The Causes of Bubble in Urban Real Estate Market

In general, the real estate price should be determined by macro-economic fundamentals. However, when the price abnormal inflates and seriously deviates from its fundamental value, a bubble will inevitably arise. The derivation of the real estate price from the fundamental value is effected by many factors.

(1) The lack of elasticity of housing supply. The scarcity of land resources determines the character that demand elasticity is greater than that of supply; when the demand for land increases, land prices will rise sharply due tothe scarcity of land. The market cannot expand the supply of land in short-run, which leads to a bigger gap between demand and supply, and thus the land prices rise further, which promotes the rise of the real estate prices. Meanwhile, there might be more speculation activities in the actual processes of real estate market. As the result, the real estate bubble forms. For example, the real estate bubble in Japan in the late 1980s greatly dues to the scarcity of land.

(2) The expectation of continuously rise of house price. Real estate is a high risk industry which is sensitive to economic cycles. The economic recovery, the real estate booms, while during the recession, real estate goes downturn. Therefore the state of the macroeconomic as well as the economic cycle will cause the expectation of boom or downturn of the real estate industry. In general, economic agents have similar expectation of the trends of real estate prices. Due to the existence of demand for real estate speculation, investors expect a higher capital return under the positive feedback mechanism. As a result, under the stimulation of high return rates, too much capital will be put into the limited land transactions. Investors purchase more current real estate in order to sell them out when prices are higher. Which leads to the increase of the demand for real estate as well as the price of real estate, then a further expectation of price increases occurs. Investors form real estate price expectation, during the purchase, consumption and investment of real estate, which contain the expectation of demand for housing. The positive feedback of demand and price expectations will cause the self- strengthening mechanism to expectation of price increase. With the irrational investment of individuals, real estate price continues to rise and results in a real estate bubble.

(3) The existence of asset bubbles requires a loose financial environment. The formation of an asset bubble has the common macroeconomic environment that is excessive money supply and loose finance credit policy. There are a lot of speculations in the financial markets and speculators earn money by buying and selling assets according to the asset price changes. Since speculators want to spread their incomes, they hold the assets in a very short period of time and their incomes are under a high risk. However, regardless of how big is the price difference of commodities or assets, without the support of enough money, the behavior of speculators will be not achieve. Therefore, the expansion of bank credit, are caused by the excessive money supply and relative loose finance credit policy leads to the asset bubble formation.

(4) The asymmetry of real estate market information. Consider the information held by different roles in real estate market, it prunes to have asymmetric information problem, which means that different parties in transaction have inconsistent information. Because of asymmetric information, the parties which hold less information will be in an inferior position. On one hand, information asymmetry is likely to cause excessive real estate speculations. As China's capital markets are underdeveloped, there are few investment channels. It makes it easy for real estate easily to become the object of speculation. A large number of domestic capital and international capital are put into the real estate market, which creates fake demand information and leads to a false market prosperity. It promotes China's real estate prices irrational rising for several years. During the process of continuous rising of real estate price, the psychological to buy when rising is strengthened. The speculative atmosphere is growing strong, and that gives economic bubbles. On the other hand, bank industry is likely to do adverse selection and moral hazard because of information asymmetry. Under the condition of asymmetric information, China's financial system is not well developed, especially state-owned banks which are the internal control system of China's banks, is incomplete. The banks lack sufficient attention to credit status of borrowers, and blindly expanse the real estate credit business, which leads to moral hazard. Conversely, moral hazard makes a lot of bank credit capital flows into the real estate market, and accelerates the real estate bubble.