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The Role of Housing-Dominated Attributes in Housing Booms: Evidence from China

Summary: This paper investigates the dominant attribute of housing in China for the period 2000 to 2017 with national monthly data. By employing VAR methodology and Chow test, the empirical results suggest that there is a statistically significant structural breakpoint in February 2009, and that the housing boom before 2009 was driven by self-occupation consumption demand while the rise in house prices since 2009 is a monetary phenomenon. These are consistent with the institutional backgrounds, when the first period encountered the end of housing as a welfare and rapid urbanization and the second period experienced the expansionary monetary policy introduced at the end of 2008. This implies that housing is gradually evolving from a necessity to a financial item, and policymakers should adopt policies that address the dominant attributes of housing at different periods.

Keywords: Housing attribute, Money supply, Housing prices, Structural breakpoint analysis.

JEL: B41, C13, C22, R21, R29.

The housing sector is an important part of the economy (Robert H. Edelstein and Kyung-Hwan Kim 2004; John Muellbauer 2015; Hong Zhang et al. 2016; Philip Arestis, Lai Mianshan, and Jia Hou 2023), which, throughout history, has also been proven to be the source of vulnerability and crisis, as housing booms and busts affect both financial stability and the real economy. According to Min Zhu (2014), research conducted by the International Monetary Fund (IMF) shows that of the nearly 50 systemic banking crises in recent decades, more than 2/3 occurred after the boom-bust patterns in house prices. In terms of its impact on the real economy, research on OECD countries (Zhu, op. cit.) shows that a housing-price bust is more likely to result in recessions, which tend to be much deeper and cause higher unemployment rates than normal recessions. Therefore, housing-price fluctuations must be considered by policymakers to avoid boom-bust cycle. This is especially true for China, where the housing industry is the backbone of the national economy, and this national economy is going through a transition period that makes it more vulnerable and sensitive to radical housing-price fluctuations.

As a result, governments have introduced a series of housing policies, and academic studies have been conducted on the effects of these housing policies. The dual

nature of housing has an impact on the effectiveness of housing policy, so it is necessary to study the dual nature of housing. Housing has gradually evolved into two properties, both as consumer goods for living and as capital goods for investment or even speculation. When the government formulates real estate policies, it has different positioning for the nature of housing, and hence the implementation effect of the policies is completely different (Shanqi Yang 2018). Therefore, it is vital to identify the dominant attribute of housing at the targeting period. The impact of housing price increases caused by investment demand generated by irrational demand on the economy is different from that caused by consumer demand generated by reasonable self-occupancy demand. Due to the close connection between the housing market and the macro economy, judging the dominant attributes of housing can help determine the impact of housing prosperity on the economy.

This paper first establishes a housing model based on the Arestis and Elias Karakitsos (2010) contribution for the analysis of the determinants of house prices, and then builds a Vector Auto-regression model based on nationwide monthly data in China for a structural breakpoint analysis. This is used to analyze the dominant attributes of housing in China's housing market. This paper also provides a literature contribution on the impact of institutional and macroeconomic changes on the dominant attributes of housing. This paper divides the research period into two time periods based on a structural breakpoint. The first period was in the institutional context of housing commercialization reform, where housing was no longer a welfare and people had a high demand for self-occupation housing. At the same time, China was in a rapid stage of urbanization during this period, which strengthened the demand for self-occupied housing. The empirical evidence in this paper confirms that the dominant attribute of housing in China during this period was housing consumption goods. In the second period, the Chinese government introduced a series of policies, namely the four trillion-yuan plan, in response to the 2008 global financial crisis. In such a loose monetary policy environment, unprecedented money supply spread to various industries, including the real estate market. The major changes in the macroeconomic environment inevitably had impacts on the real estate market. Therefore, there is a saying that the four trillion-yuan plan is the cause for the rise in real estate prices. This paper empirically confirms that the post crisis housing market boom is indeed a monetary phenomenon.

The rest of the paper proceeds as follows: Section 1 reviews the relevant literature; Section 2 explains the housing model used for the purpose of this contribution; Section 3 provides the empirical evidence and discusses the main results; and Section 4 summarizes and concludes.

1. Literature Review

This section reviews the relevant literature, focusing on the dual nature of housing as a consumption good and as an investment vehicle. Firstly, we review studies on the dominated attributes. By the end of 1998, when China fully implemented the reform of the urban housing system, the investment attribute of housing began to appear (Chuanyong Zhang, Luo Feng, and Zhilan Huang 2020). Jiating Wang and Huanzhao Zhang (2006) study the two types of housing demands and point out the location where each type dominates. In the Midwest area of China, the self-occupied demand is the

majority, but in the Eastern area in China, particularly in the Yangtze River Delta region, investment-oriented demand accounts for a considerable proportion. Jiancheng Zhou (2007) suggests that real estate has different attributes and functions at different stages of development, confirms the existence of real estate investment attribute theoretically, and claims that the evolution of real estate attributes conforms to the law of economic and social development. Zhou's (op. cit.) study provides a comprehensive analysis of real estate attributes, but only from a theoretical perspective. Later, some studies combined empirical analysis to study the two attributes. Jianrong Yang (2012) estimated China's major urban housing consumption demand and investment demand, concluding that the housing demand for investment in China's 35 large and medium-sized cities increased after 2006. However, this study started with sample data in 1998 and ended in 2008. In 2008, due to the global financial crisis, the Chinese government took a series of policy packages and the macro environment changed. As a result, the real estate market underwent changes in 2008, and the dominant attributes of housing inevitably changed. Therefore, if the sample period is extended, the expected research results will be very different. There are also studies specifically targeting the housing attributes of individual cities. For example, Zhenpo Wang, Man Xi, and Liyan Wang (2018) set up a joint modeling of housing consumption demand, investment demand and tenure choice based on survey questionnaires conducted in the Tianjin city and found that the housing investment demand of households far exceeds the consumption demand. This is consistent with the finding in Tingting Liu and Dian Zhang (2015), which concludes that the housing investment demand of Chinese urban households is greater than the housing consumption demand. Later, Guanyu Liu (2019) used the state space model to study the evolution process of Shanghai real estate attributes and the study found that the frequent-changing estate policies exert a strong effect on the evolution of housing attributes.

The second branch focuses on housing attributes and housing prices. Yannis M. Ioannides and Stuart S. Rosenthal (1994) explore the decision-making process of renting and buying a house, where the housing value is mainly determined by demand for housing consumption rather than investment demand; and investment demand is more influenced by wealth and income, while consumer demand is more influenced by age, education, household size and suburban cities. Zhenyu Huang, Dong Ji, and Lichun Wu (2020) built a DW Four-Quadrant modified model and used it to empirically study the relationship between the dual attribute characteristics and housing prices. The result is that the housing price level is mainly affected by the investment attribute, while the consumption attribute of real estate does not significantly affect the urban housing price level. Zan Yang, Fan Ying, and Liqing Zhao (2018) *via* capturing the dual nature of Chinese housing, identified a negative correlation between housing price and household consumption, and found that the demand for second housing units is motivated by increasing housing consumption demand rather than pure investment needs.

The third branch explores the relationship between consumption and investment attributes and other variables. In the theoretical study of residential decision-making behaviour, some studies only consider the single attribute of the dual nature of housing. For example, the consumer demand model is constructed based only on the consumption attributes of housing (Guozhong Zhu 2011), or the allocation of housing in the

portfolio is discussed based only on the investment attributes of housing (Jan K. Brueckner 1997; Rui Yao and Harold H. Zhang 2005; Monika Piazzesi and Martin Schneider 2007; Marjorie Flavin and Shinobu Nakagawa 2008). Some studies also take into account dual attributes. Yang, Huan Zhang, and Zhao (2014) conclude that the dual nature of consumption and investment is often difficult to separate, and both play a role in residents' consumption decisions. Ioannides and Rosenthal (1994) used household data from the 1983 Survey of Consumer Finances to estimate an ordered Probit model and found that investment demand is more sensitive to wealth and income than consumption demand, but that consumption demand is more sensitive to demographic variables and proximity to urban suburbs. Some scholars use wealth effect to measure the impacts of the dual attributes. Haiyong Liao and Zhang Chen (2015) quantitatively analyzed the difference of influence of the two attributes on the real estate wealth effect. The results show that wealth effect is proportional to the consumption attribute, while it is inversely proportional to investment attribute. Similarly, Zhongfei Li, Yu Shoujin, and Jun Zheng (2016) focused on the relationship between income gap and housing prices in China from the perspective of the dual attributes of real estate. The empirical results indicate that there is no significant correlation between income gap and housing prices and the single attribute is not obvious. But as time goes on, the role of income inequality in housing prices transfers to promoting, while the real estate transfers from consuming goods to investment or even speculating properties. Cheng Li and Ying Zhang (2021) analyzed macro data from 14 countries and found that there was a general relationship between the values of housing consumption and investment, and that this relationship is influenced by public policies, such as government spending and financial measures.

2. Theoretical Framework

This paper builds a theoretical framework considering China's economic, institutional, and social background (see also, Arestis and Karakitsos 2010). In economic theory, the law of supply and demand determines the market price of a commodity or service. Housing as a commodity, its price is determined by the interaction of supply of and demand for housing in the market. This paper assumes that there are four participants directly participating in China's housing market, as stated above, namely local governments, commercial banks, housing purchasers, and property developers. Moreover, there is one participant indirectly participating in China's housing market, namely the People's Bank of China (PBC). Moreover, the equilibrium price of housing in China is the interaction of the behaviour of the economic agents in the relevant markets. The behaviour of the economic agents is associated with the relevant key variables that influence house prices in China.

Based on the above assumption, this paper proposes a theoretical model of the China housing market, as represented in the equations below. Equation (1) represents demand of housing and Equation (2) represents supply of housing. Equation (3) represents the long-run relationship or the equilibrium equation for house prices, which emerges when demand and supply are equal in the long run. Therefore, putting

Equations (1) and (2) equal to each other, as in the long-run equilibrium, and solving for HP, Equation (3) emerges.

Let DH denote demand for housing, Yd for income, HP for house price, CPI for consumer price index, M2 for money supply, Shares for the stock trading volume, SH for supply of housing, LR for lending rate, LP for land price, GDP for gross domestic product, IR for interest rate. We can then write:

$$D_H = D_H \underset{(+)\ (-)\ (-)\ (+)\ (+)\ (-)}{(Yd, MR, HP, CPI, M2, Shares)}; \tag{1}$$

$$S_H = S_H \underset{(+)\ (-)\ (+)\ (+)}{(HP, LR, LP, GDP)}; \tag{2}$$

$$P_H = P_H \underset{(+)\ (-)\ (+)\ (+)\ (+)\ (+)\ (-)\ (-)}{(Yd, HP, LP, GDP, CPI, M2, Shares, IR)}. \tag{3}$$

3. Empirical Investigation and Discussions

This section presents the results of the empirical investigations, which refers to the structural breakpoint analysis. Specifically, time series analysis is applied.

3.1 Data Description and Sources

According to the *China Housing Development Report (2018-2019)*, in 2018, the Chinese government substantially frequently introduced real estate regulation policies, and the number of real estate regulation reached 405 times, an increase of nearly 80% over the same period in 2017. Therefore, the sample period in this paper is selected from the beginning stage of the housing marketization reform until 2017. Besides, due to the fact that the Chinese New Year usually falls between January and February, and the trading volume during the holiday period is relatively low, the data released by the National Bureau of Statistics does not have separate data for January and the data for January and February are consolidated. Therefore, the data sample for this paper starts with the data from March. The empirical analysis of the structural break employs monthly data for the period 2000:M03 to 2017:M12. Following our earlier theoretical analysis, this paper focuses on the following variables: house price growth rate (HPGROWTH), GDP growth rate (GDPGROWTH), Consumer Price Index (CPI), money supply growth rate (M2GROWTH), real interest rate (INTEREST), land purchased (LAND), and shares trading volume (SHARES).

▪ The standardization of house prices is challenging. Different house price indices cover different geographical areas and time frequencies, such as the sales price indices of residential buildings in 70 large and medium-sized cities. The monthly house price growth rate (HPGROWTH) data are obtained through the following steps:

1. We have downloaded two data series from National Bureau of Statistics of China (NBS): Total Sale of Commercialized Residential Buildings Sold,

accumulated (100 million yuan)[1], and Floor Space of Commercialized Residential Buildings Sold, Accumulated (10000 square meters)[2].

2. The series Total Sale of Commercialized Residential Buildings Sold is divided by the series Floor Space of Commercialized Residential Buildings Sold to get monthly house prices.
3. Since there is no data for January, the data for January is interpolated using the linear interpolation method.
4. Calculate the monthly growth rate of house price using the formula:

$$\text{HPGROWTH} = \frac{\text{HPt} - \text{HPt}-1}{\text{HPt}-1} * 100\%.$$

▪ The quarterly data set for GDP (100 million yuan) is provided by the NBS and covers the period 2000-2018. The frequency conversion from quarterly to monthly was undertaken by EViews. Then the monthly GDP growth rate is calculated using formula:

$$\text{GDPGROWTH} = \frac{\text{GDPt} - \text{GDPt}-1}{\text{GDPt}-1} * 100\%.$$

▪ The data series *Money and Quasi-Money (M2) Supply, period-end (100 million yuan)*[3] is available from the NBS. The growth rate is calculated using the formula:

$$\text{M2GROWTH} = \frac{\text{M2t} - \text{M2t}-1}{\text{M2t}-1} * 100\%.$$

▪ The monthly Consumer Price Index (CPI) is available from the Organization for Economic Co-operation and Development, Main Economic Indicators - complete database. Since all the time series used in this paper start in March 2000, this date is chosen to equal 100.

▪ The annul real interest rate (%) is available from The World Bank, and it is converted into monthly real interest rate (INTEREST).

▪ The data, Development and Sales of Real Estate, Land Space Purchased, accumulated (10000 square meters)[4] is available from the NBS. The data series land space purchased (10000 square meters) is logged.

▪ The monthly stock trading volume that are traded at the Shanghai Stock Exchange is available from the Shanghai Stock Exchange website.

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[1] "Value of Commercialized Housing Sold refers to the total contracted value (i.e., value of sales/purchase for selling/purchase of commercialized housing as designated in the contract signed by both sides) during the reference time. This indicator has the same coverage as the area of commercialized housing sold, which constitutes floor space of completed housing and floor space of housing yet to be completed" (NBS, Explanatory Notes of Indicators 2018).

[2] "Area of Commercialized Housing Sold refers to total contracted area of commercialized housing (i.e., area of floor space as designated in the formal contracts signed by both sides) during the reference time. It constitutes floor space of completed housing and floor space of future housing" (NBS, Explanatory Notes of Indicators 2018).

[3] "Money supply includes deposits of Housing Provident Fund Management Centre and deposits of non-depository corporations in depository corporations. Since June in 2001, the margin account of security companies maintained with financial institutions, part of Other Deposits, are included in money supply (M2)" (NBS, Note 2018).

[4] "Land space purchased this year refers to land area in the year through a variety of ways to obtain the land use rights" (NBS, Note 2018).

Table 1 presents the results for the descriptive statistics of all the variables described above for the whole period, which is from March 2000 to December 2017. In this sample, there are 214 observations for each variable used in the following empirical tests, and measures of central tendency and variability for each variable is shown in the table.

Table 1 Descriptive Statistics

	HPGROWTH	GDPGROWH	CPI	M2GROWTH	INTEREST	LNLAND	SHARES
Mean	0.006595	0.012585	120.3222	0.012430	2.047235	7.784725	198.6003
Median	-0.000450	0.021400	119.5448	0.011650	2.635882	7.840186	148.4900
Maximum	0.150000	0.102300	147.4709	0.063300	5.451197	9.223925	1319.360
Minimum	-0.115600	-0.143300	97.33417	-0.012700	-2.334663	5.996240	7.960000
Std. dev.	0.035929	0.052212	16.46981	0.010753	2.414002	0.522994	226.5575
Skewness	0.958751	-0.989575	0.139369	0.816103	-0.432668	-0.192158	2.579002
Kurtosis	6.302833	4.585012	1.541270	5.228501	1.775615	3.632742	11.58339
Jarque-Bera	130.0542	57.32787	19.66649	68.03697	20.04401	4.886878	894.1596
Probability	0.000000	0.000000	0.000054	0.000000	0.000044	0.086862	0.000000
Sum	1.411300	2.693100	25748.95	2.660000	438.1083	1665.931	42500.47
Sum sq. dev.	0.274961	0.580654	57777.27	0.024628	1241.237	58.26041	10932926
Observations	214	214	214	214	214	214	214

Source: Authors' compilation from EViews 10.

3.2 Methodology: Time Series Analysis

The empirical investigation in this paper includes building Vector Autoregressive (VAR) models and conducting a Chow test. VAR models were introduced by Christopher A. Sims (1980) and have been since then an important instrument in macroeconomic research. The traditional macro-econometric procedure is to classify variables as either exogenous or endogenous, where the former refers to those determined outside the system and hence treated independently, and the latter are determined by its relationship with other variables within the model. In VAR models, variables are not required to be specified as endogenous or exogenous because all variables are endogenous in VAR models. Another feature of VAR models is that "economic theory places only weak restrictions on the reduced form coefficients and on which variables that should enter a reduced form model" (Hilde Christiane Bjørnland 2000, p. 5). So far, there is no classical economic theory about the impact of macro-environment changes on house price growth, so VAR models are very suitable for the empirical study in this paper. Therefore, VAR models are employed and all the variables, which refer to HPGROWTH, GDPGROWTH, CPI, M2GROWTH, INTEREST, LAND, and SHARES, are endogenous. "However, VAR models have also been much criticised, although the criticism usually refers to particular applications and interpretations of empirical results, rather than the methodology itself" (op. cit., p. 5). One of major limitations of VAR models is that VAR models use little economic theory, hence policymakers must be careful in obtaining economic policy prescriptions. Based on common sense and relevant literature, causality could run in either direction or both between these variables, therefore Granger causality tests are also performed.

In order to deal with the global financial crisis, China's central government took a series of policy interventions, which led to great changes in China's macroeconomic environment. This paper believes that the housing market inevitably affected by changes in the macroeconomic environment and determinants of house price growth rates before and after the financial crisis may change. That is, the sample data may have a break point splitting the data set (March 2000 to December 2017) into two parts. Therefore, this paper conducts a structural break test to assess the house-price growth rate model using the 2008 financial crisis as a break point. The Chow test (Gregory C. Chow 1960) is commonly used in time series analysis to test for the presence of a structural break point with a known break date. Data are split at specified break point, in the case of this paper, the specified break point refers to February 2009 (as suggested in Table 8).

Unit roots are one cause for non-stationarity; therefore, unit root tests are used here to test the stationarity in the time series analysis below. There are many types of unit root tests; this thesis applies to the frequently used one, namely the Augmented Dickey-Fuller (AD) test. Table 2 presents the unit root test results by using the AD test. Some of the variables are stationary in level; others, which refer to GDPGROWTH, M2GROWTH and SHARES are I (1). Therefore, these three data series are differenced and used in the following Vector Auto- Regression (VAR) model construction.

Table 2 Unit Root Tests

Variables	Level	1st difference	Status
HPGROWTH	-4.272714 ***		I (0)
GDPGROWTH	-1.995371	-10.85562***	I (1)
CPI	-3.836377 **		I (0)
M2GROWTH	-2.272471	-10.96839 ***	I (1)
INTEREST	-2.290309 **		I (0)
LNLAND	-3.240470 **		I (0)
SHARES	-2.011706	-17.72491 ***	I (1)

Notes: ** and *** denote significant level at 5% and 1%, respectively.

Source: Authors' compilation from EViews 10.

There are several methods to select the lag length of a VAR. The Schwarz Information Criterion (SC) or the Bayesian Information Criterion (BIC) is used for the VAR lag-order selection criteria here. The model with the lowest SC is preferred, which is closely related to the Akaike Information Criterion (AIC). Table 3 presents the lag order selection result for the period from March 2000 to December 2017, which indicates that lag 3 is the lag order selected by the criterion, and therefore used in the subsequent analysis and denote as VAR (3).

Table 4 presents the of roots of characteristic polynomial VAR (3), which indicate that no root lies outside the unit circle and hence VAR (3) satisfies the stability condition and is ready for the next step analysis.

Table 3 VAR Lag Order Selection

Endogenous variables: HPGROWTH DGDPGROWTH CPI DM2GROWTH INTEREST LNLAND DSHARES
Exogenous variables: C
Sample: 2000M03 2017M12
Included observations: 210

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1464.167	NA	0.002868	14.01111	14.12268	14.05622
1	-429.4898	1990.521	2.40e-07	4.623713	5.516275	4.984542
2	-215.9281	396.6146	5.02e-08	3.056458	4.730012	3.733014
3	-35.27149	323.4614*	1.44e-08*	1.802586*	4.257131*	2.794867*

Notes: * indicates lag order selected by the criterion; LR: sequential modified LR test statistic (each test at 5% level); FPE: final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion.

Source: Authors' compilation from EViews 10.

Table 4 Roots of Characteristic Polynomial VAR (3)

Endogenous variables: HPGROWTH DGDPGROWTH
CPI DM2GROWTH INTEREST LNLAND DSHARES
Exogenous variables: C
Lag specification: 1 3

Root	Modulus
0.998967	0.998967
-0.958974	0.958974
0.942136	0.942136
0.478507 - 0.797767i	0.930269
0.478507 + 0.797767i	0.930269
-0.409632 + 0.778638i	0.879816
-0.409632 - 0.778638i	0.879816
0.833419	0.833419
-0.120065 - 0.747543i	0.757123
-0.120065 + 0.747543i	0.757123
-0.596667 - 0.455302i	0.750541
-0.596667 + 0.455302i	0.750541
-0.283398 - 0.548260i	0.617173
-0.283398 + 0.548260i	0.617173
0.152005 + 0.408258i	0.435637
0.152005 - 0.408258i	0.435637
0.422406 + 0.060758i	0.426753
0.422406 - 0.060758i	0.426753
-0.247944	0.247944
0.212423	0.212423
0.065477	0.065477

Source: Authors' compilation from EViews 10.

Table 5 presents the results for the pairwise Granger Causality tests for the whole sample period, which is from March 2000 to December 2017 with the proper lag order of 3. The results suggest that we cannot reject the hypothesis that CPI does not Granger cause house price growth (p-value = 0.0724); however, we do reject the hypothesis that house price growth does not Granger cause CPI (p-value = 0.0024). Therefore, it appears that Granger causality runs one-way from house price growth and

not the other way. In addition, since the p-values of DGDPGROWTH (*p*-value = 1.E-14), DM2GROWTH (*p*-value = 1.E-13), LNLAND (*p*-value = 6.E-07) are so low, then we can say that the coefficients of these variables in the model with GDPGROWTH as the dependent variable are not equal to zero and so they affect the future performance of house price growth. Therefore, it can be concluded that Granger causality does run between DGDPGROWTH, DM2GROWTH, LNLAND and house price growth in both ways. Moreover, the results reveal that neither interest (*p*-value = 0.9742) nor DSHARES (*p*-value =0.5012) Granger cause house price growth.

Table 5 Pairwise Granger Causality Tests

Sample: 2000M03 2017M12
Lags: 3

Null hypothesis:	Obs.	F-statistic	*p*-value
DGDPGROWTH does not Granger cause HPGROWTH	210	26.9938	1.E-14
HPGROWTH does not Granger cause DGDPGROWTH		8.69704	2.E-05
CPI does not Granger cause HPGROWTH	211	2.36246	0.0724
HPGROWTH does not Granger cause CPI		4.94893	0.0024
DM2GROWTH does not Granger cause HPGROWTH	210	24.8275	1.E-13
HPGROWTH does not Granger cause DM2GROWTH		7.55100	8.E-05
INTEREST does not Granger cause HPGROWTH	211	0.07330	0.9742
HPGROWTH does not Granger cause INTEREST		0.23946	0.8688
LNLAND does not Granger cause HPGROWTH	211	11.3566	6.E-07
HPGROWTH does not Granger cause LNLAND		3.80267	0.0111
DSHARES does not Granger cause HPGROWTH	210	0.78920	0.5012
HPGROWTH does not Granger cause DSHARES		0.38167	0.7663

Source: Authors' compilation from EViews 10.

This paper focuses on house price growth rate as a dependent variable, and hence only one of the VAR estimates, which refers to the house price growth rate (HPGROWTH) as the dependent variable, is used in the following structural breakpoint test.

Table 6 presents the output estimation, where HPGROWTH is the dependent variable. It shows the estimations for the whole period, which is from July 2000 to December 2017. The F-statistic [F-statistic = 9.070187, Prob(F-statistic) = 0.000000)] suggests the data in this period provides sufficient evidence to conclude the regression model fits the data better than the model with no independent variables. The regression model accounts for 50% of the variance (R-squared = 0.503268). Specifically, with the proper lag order of 3, the first, second, and third- order lag of the variable DM2GROWTH are all significant at 0.01 level; the first, second, and third-order lag of the variable DGDPGROWTH is significant at 0.05 level. The land factor is significant at first and third order lags. For the house price growth rate itself, only the second-order lag is significant at 0.05 level; and for CPI, only the third-order lag is significant at 0.05 level. Both variables, interest and DSHARES are not statistically significant at all.

Table 6 Output Estimation

Dependent variable: HPGROWTH
Method: least squares
Sample (adjusted): 2000M07 2017M12
Included observations: 210 after adjustments

Variable	Coefficient	Std. error	*t*-statistic	*p*-value
HPGROWTH(-1)	0.073712	0.079810	0.923594	0.3569
HPGROWTH(-2)	-0.324759	0.080230	-4.047842	0.0001
HPGROWTH(-3)	0.135754	0.072480	1.872991	0.0626
DGDPGROWTH(-1)	-0.128881	0.049789	-2.588559	0.0104
DGDPGROWTH(-2)	-0.181627	0.046750	-3.885065	0.0001
DGDPGROWTH(-3)	-0.104797	0.046981	-2.230628	0.0269
CPI(-1)	0.001522	0.003453	0.440901	0.6598
CPI(-2)	0.006533	0.005288	1.235482	0.2182
CPI(-3)	-0.008129	0.003335	-2.437594	0.0157
DM2GROWTH(-1)	0.711189	0.209373	3.396758	0.0008
DM2GROWTH(-2)	0.962320	0.247161	3.893492	0.0001
DM2GROWTH(-3)	0.523285	0.201337	2.599048	0.0101
INTEREST(-1)	0.001812	0.002102	0.861972	0.3898
INTEREST(-2)	-0.000909	0.002947	-0.308315	0.7582
INTEREST(-3)	-6.54E-05	0.002110	-0.031006	0.9753
LNLAND(-1)	0.016105	0.005645	2.852949	0.0048
LNLAND(-2)	0.003701	0.005306	0.697416	0.4864
LNLAND(-3)	-0.017193	0.005768	-2.980816	0.0033
DSHARES(-1)	8.95E-06	2.13E-05	0.421192	0.6741
DSHARES(-2)	2.36E-05	1.84E-05	1.277187	0.2031
DSHARES(-3)	7.58E-06	2.12E-05	0.357723	0.7210
C	-0.007615	0.051218	-0.148676	0.8820
R-squared	0.503268		Mean dependent var	0.007165
Adjusted R-squared	0.447782		S.D. dependent var	0.035613
S.E. of regression	0.026465		Akaike info criterion	-4.327142
Sum squared resid	0.131673		Schwarz criterion	-3.976493
Log likelihood	476.3499		Hannan-Quinn criter.	-4.185388
F-statistic	9.070187		Durbin-Watson stat	1.997467
Prob(F-statistic)	0.000000			

Source: Authors' compilation from EViews 10.

Table 7 presents the Breusch-Godfrey serial correlation LM test of the above equation. The null hypothesis of this test is that there is no serial correlation in the residuals up to the specified order. Since the *p*-value of 0.2623 is greater than 0.05, the test cannot reject the hypothesis of no serial correlation up to order three. Therefore, the above equation, which contains the house price growth rate (HPGROWTH) as the dependent variable and the rest as independent variables, is of no serial correlation up to order three and can be proceeded to the structural change test.

Since the break date is known, as hypothesized in 2009:M02, Chow test is used to test the structural change. Table 8 presents the Chow test result. Since the *p*-value is 0.0496, we can reject the null hypothesis that there is no break at the specified break-point February 2009. Therefore, based on the analysis and results above, this paper concludes that there is a structural breakpoint in February 2009, and hence the sample

used as a whole in the above analysis can be divided into two subsamples, period one (from March 2000 to January 2009) and period two (from February 2009 to December 2017). The subsequent analysis compares the empirical results between these two periods.

Table 7 Breusch-Godfrey Serial Correlation LM Test

			p-value
F-statistic	1.341446	Prob. F(3,185)	0.2623
Obs*R-squared	4.470911	Prob. Chi-Square (3)	0.2149

Source: Authors' compilation from EViews 10.

Table 8 Chow Breakpoint Test

Chow breakpoint test: 2009M02
Null hypothesis: no breaks at specified breakpoints
Varying regressors: all equation variables
Equation sample: 2000M07 2017M12

			p-value
F-statistic	1.608700	Prob. F(22,166)	0.0496
Log likelihood ratio	40.58513	Prob. Chi-square(22)	0.0092
Wald statistic	35.39140	Prob. Chi-square(22)	0.0352

Source: Authors' compilation from EViews 10.

3.3 Period One Analysis

Table 9 presents the results for the descriptive statistics of all the variables described in the first sub-sample period, which is from March 2000 to January 2009. In this subsample, there are 107 observations for each variable used in the subsequent tests. Compared to the whole sample period, the central tendency and variability of the data set in this sub-sample is smaller.

Table 9 Descriptive Statistics of Period One

	HPGROWTH	GDPGROWH	CPI	M2GROWTH	INTEREST	LNLAND	SHARES
Mean	0.006530	0.013242	105.9080	0.013279	1.613185	7.742826	63.71299
Median	0.000300	0.021900	104.5006	0.012500	2.109240	7.838588	29.66000
Maximum	0.110400	0.101600	121.4869	0.063300	5.451197	9.223925	291.4200
Minimum	-0.086500	-0.143300	97.33417	-0.009700	-2.334663	5.996240	7.960000
Std. dev.	0.033702	0.052461	6.922562	0.010550	2.324924	0.616805	69.63852
Skewness	0.705182	-1.065927	0.862379	1.140849	-0.372308	-0.111586	1.618213
Kurtosis	4.728284	4.641679	2.622040	6.986610	1.841297	3.218947	4.842083
Jarque-Bera	22.18507	32.27793	13.89948	94.06725	8.457660	0.435771	61.82696
Probability	0.000015	0.000000	0.000959	0.000000	0.014569	0.804218	0.000000
Sum	0.698700	1.416900	11332.16	1.420900	172.6108	828.4823	6817.290
Sum sq. dev.	0.120400	0.291725	5079.717	0.011798	572.9590	40.32753	514049.5
Observations	107	107	107	107	107	107	107

Source: Authors' compilation from EViews 10.

Table 10 presents the unit root test results by using the AD test type. Some of the variables are stationary in level; others are I (1). Therefore, GDPGROWTH, CPI and INTEREST series are differenced in the VAR for period one.

Table 10 Unit Root Tests

Variables	Level	1st difference	Status
HPGROWTH	-2.801576*	-9.053576 ***	I (0)
GDPGROWTH	-0.867357	-2.704653 *	I (1)
CPI	-2.107158	-7.533932***	I (1)
M2GROWTH	-6.684838***		I (0)
INTEREST	-1.964487	-6.308098 ***	I (1)
LNLAND	-5.273647 ***		I (0)
SHARES	-3.579752 **		I (0)

Notes: *, ** and *** denote significant level at 10%, 5% and 1%, respectively.

Source: Authors' compilation from EViews 10.

Among the lag-order selection criteria, the Schwarz Information Criterion (SIC) suggests a lag of 1 order. However, VAR (1) has a root that lies outside the unit circle and hence VAR (1) does not satisfy the stability condition and is not chosen as the proper model. As shown in Table 11, all other criteria indicate that lag 3 is the proper lag order, and the inverse roots of AR characteristic polynomial of VAR (3), shown in Table 12, indicate no root lies outside the unit circle; hence VAR (3) satisfies the stability condition. Therefore, a VAR (3) is constructed for period one.

Table 11 VAR Lag Order Selection

Endogenous variables: HPGROWTH DGDPGROWTH DCPI M2GROWTH DINTEREST LNLAND SHARES
Exogenous variables: C
Sample: 2000M03 2009M01
Included observations: 102

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-215.0868	NA	1.84e-07	4.354643	4.534788	4.427590
1	-45.51001	312.5533	1.73e-08	1.990392	3.431554*	2.573968
2	40.75503	147.1580	8.44e-09	1.259705	3.961883	2.353909
3	149.3639	170.3669*	2.71e-09*	0.090903*	4.054098	1.695736*
4	188.8348	56.49747	3.49e-09	0.277750	5.501960	2.393211

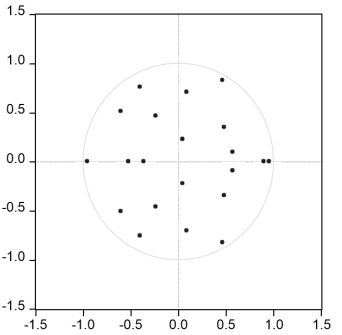
Notes: * indicates lag order selected by the criterion; LR: sequential modified LR test statistic (each test at 5% level); FPE: final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion.

Source: Authors' compilation from EViews 10.

Figure 1 shows the inverse roots of AR characteristic polynomial of VAR (3), which indicates no root lies outside the unit circle and hence VAR (3) satisfies the stability condition and adopted for the analysis here.

If people buy houses for self-occupation, they do not pay as much attention to past prices as investors or speculators do. Because for self-occupier or first-time buyer, housing is their rigid demand. On the contrary, for housing investors or speculators, housing is elastic demand. They usually are very concerned about price changes and make forecasts of house growth based on past prices. Based on this fact, this paper assumes that if past house prices have no significant impact on current house price, it

represents first-time buyer; otherwise, it represents housing investors. With this assumption, Table 12 shows the estimations for the first period and can be interpreted as follows.



Source: Authors' compilation from EViews 10.

Figure 1 Inverse Roots of AR Characteristic Polynomial

Table 12 Estimations for Period One

Dependent variable: HPGROWTH
Method: least squares
Sample (adjusted): 2000M07 2009M01
Included observations: 103 after adjustments

Variable	Coefficient	Std. error	*t*-statistic	*p*-value
HPGROWTH(-1)	0.034514	0.126477	0.272887	0.7856
HPGROWTH(-2)	-0.130406	0.122371	-1.065666	0.2897
HPGROWTH(-3)	0.020473	0.114704	0.178485	0.8588
DGDPGROWTH(-1)	-0.049600	0.064095	-0.773846	0.4413
DGDPGROWTH(-2)	-0.225852	0.059714	-3.782239	0.0003
DGDPGROWTH(-3)	-0.076949	0.063615	-1.209593	0.2300
DCPI(-1)	0.004221	0.004106	1.028182	0.3069
DCPI(-2)	0.005097	0.004326	1.178420	0.2421
DCPI(-3)	-0.009441	0.003971	-2.377515	0.0198
M2GROWTH(-1)	0.012913	0.307787	0.041955	0.9666
M2GROWTH(-2)	0.015738	0.325097	0.048410	0.9615
M2GROWTH(-3)	-0.443207	0.312750	-1.417128	0.1603
DINTEREST(-1)	0.000789	0.004200	0.187742	0.8515
DINTEREST(-2)	-0.003450	0.004197	-0.822017	0.4135
DINTEREST(-3)	-0.002193	0.004208	-0.521281	0.6036
LNLAND(-1)	0.016551	0.006771	2.444272	0.0167
LNLAND(-2)	0.017688	0.006215	2.846128	0.0056
LNLAND(-3)	-0.025705	0.006882	-3.735291	0.0003
SHARES(-1)	0.000236	8.80E-05	2.679911	0.0089
SHARES(-2)	-7.25E-05	0.000118	-0.613897	0.5410
SHARES(-3)	-0.000172	9.48E-05	-1.814496	0.0733
C	-0.053769	0.049900	-1.077536	0.2844
R-squared	0.610157		Mean dependent var	0.007689
Adjusted R-squared	0.509086		S.D. dependent var	0.032908
S.E. of regression	0.023057		Akaike info criterion	-4.514761

Sum squared resid	0.043063	Schwarz criterion	-3.952003
Log likelihood	254.5102	Hannan-Quinn criter.	-4.286825
F-statistic	6.036938	Durbin-Watson stat	2.021852
Prob(F-statistic)	0.000000		

Source: Authors' compilation from EViews 10.

The coefficients on house price growth are statistically not significant, which suggests that the past house price growth has no impact on current house price growth. According to the assumption made to distinguish first-time buyers and investors, this suggests that people buy houses for self-occupation, rather than investment or speculation. This is particularly consistent with the situation at that time. Housing as a welfare item, ended in 1998, and since then people start to buy commercial residential housing. The demand for self-occupation, which is also enhanced by the rapid urbanization, led to a housing boom. That is, the housing boom in period one, from 2000 to 2009, resulted from owner-occupied housing demand. Housing in this period was dominated by its consumption attribute. The monetary variables, money supply growth and real interest rate are not statistically significant. This confirms that owners, rather than investors or speculators, dominated house purchasers. The coefficients for the land space purchased variable are highly statistically significant. The coefficient on lagged GDP growth (as a proxy for income) is statistically highly significant at 1 percent level for lag of one month.

Table 13 Pairwise Granger Causality Tests

Sample: 2000M03 2009M01
Lags: 3

Null hypothesis:	Obs	F-statistic	*p*-value
DGDPGROWTH does not Granger cause HPGROWTH	103	13.0051	3.E-07
HPGROWTH does not Granger cause DGDPGROWTH		5.07229	0.0026
DCPI does not Granger cause HPGROWTH	103	1.59216	0.1963
HPGROWTH does not Granger cause DCPI		1.73989	0.1640
M2GROWTH does not Granger cause HPGROWTH	104	9.16195	2.E-05
HPGROWTH does not Granger cause M2GROWTH		3.45579	0.0194
DINTEREST does not Granger cause HPGROWTH	103	0.27759	0.8414
HPGROWTH does not Granger cause DINTEREST		0.18251	0.9080
LNLAND does not Granger cause HPGROWTH	104	11.5771	1.E-06
HPGROWTH does not Granger cause LNLAND		2.37587	0.0747
SHARES does not Granger Cause HPGROWTH	104	2.53180	0.0615
HPGROWTH does not Granger Cause SHARES		1.47792	0.2254

Source: Authors' compilation from EViews 10.

Table 13 presents the results for the pairwise Granger Causality tests for the first sample period, which is from March 2000 to January 2009 with the proper lag order of 3. The results suggest that we cannot reject the hypothesis that house price growth does not Granger cause LNLAND (p-value = 0.0747) but we do reject the hypothesis that LNLAND does not Granger cause house price growth (p-value =1. E-06). Therefore, it appears that Granger causality runs one-way from LNLAND to house price growth and not the other way. In addition, since the p-values of

DGDPGROWTH (p-value = 3.E-07) and M2GROWTH (p-value = 2.E-05) are so low, then we can say that the coefficients of these variables in the model with GDPGROWTH as the dependent variable are not equal to zero and so they affect the future performance of house price growth. Therefore, it can be concluded that Granger causality does run between DGDPGROWTH, M2GROWTH and house price growth in both ways. Moreover, the results reveal that DCPI (p-value = 0.1963), DINTEREST (p-value = 0.8414), SHARES (p-value = 0.0615) do not Granger cause house price growth.

3.4 Period Two Analysis

Table 14 presents the results for the descriptive statistics of all the variables described in the second sub-sample period, which is from February 2009 to December 2017. In this sample, there are 107 observations for each variable used in the subsequent tests. The central tendency and variability of this data set is like the one in the first sub-sample.

Table 14 Descriptive Statistics of Period Two

	HPGROWTH	GDPGROWH	CPI	M2GROWTH	INTEREST	LNLAND	SHARES
Mean	0.006660	0.011927	134.7364	0.011580	2.481285	7.826625	333.4877
Median	-0.001200	0.020900	136.2693	0.010600	3.523223	7.849300	269.1000
Maximum	0.150000	0.102300	147.4709	0.047200	5.451197	9.001500	1319.360
Minimum	-0.115600	-0.134600	117.9980	-0.012700	-1.472140	6.983847	104.5600
Std. dev.	0.038185	0.052200	8.814228	0.010936	2.433959	0.406981	248.1105
Skewness	1.122642	-0.912912	-0.475093	0.554678	-0.572803	-0.030442	2.409666
Kurtosis	7.100024	4.536553	2.040138	3.599162	1.743355	2.657832	8.932878
Jarque-Bera	97.42124	25.38855	8.132840	7.087253	12.89159	0.538502	260.4781
Probability	0.000000	0.000003	0.017139	0.028908	0.001587	0.763952	0.000000
Sum	0.712600	1.276200	14416.79	1.239100	265.4975	837.4489	35683.18
Sum sq. dev.	0.154561	0.288836	8235.205	0.012676	627.9605	17.55719	6525233.
Observations	107	107	107	107	107	107	107

Source: Authors' compilation from EViews 10.

Table 15 presents the unit root test results by using Augmented Dickey-Fuller test type. In this setup, only house price growth (HPGROWTH) is stationary at level, others are stationary at first difference.

Table 15 Unit Root Tests

Variables	Level	1st difference	Status
HPGROWTH	-4.045801 ***		I (0)
GDPGROWTH	-2.005646	-4.402226 ***	I (1)
CPI	-1.713271	-8.804049 ***	I (1)
M2GROWTH	-2.499689	-7.833737 ***	I (1)
INTEREST	-1.932631	-10.18197 ***	I (1)
LNLAND	-0.445890	-2.661878 *	I (1)
SHARES	-2.003902	-12.76770 ***	I (1)

Notes: * and *** denote significant level at 10% and 1%, respectively.

Source: Authors' compilation from EViews 10.

Table 16 presents the lag order-selection result, indicating that lag 3 is the lag-order selected by the relevant criterion. Therefore, a VAR (3) is constructed.

Table 16 VAR Lag Order Selection

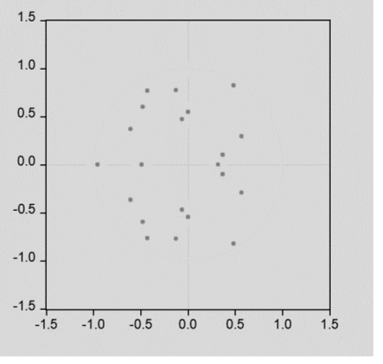
Endogenous variables: HPGROWTH DGDPGROWTH DCPI DM2GROWTH DINTEREST DLNLAND DSHARES
Exogenous variables: C
Sample: 2009M02 2017M12
Included observations: 102.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-274.8085	NA	5.92e-07	5.525657	5.705802	5.598604
1	-176.6737	180.8760	2.26e-07	4.562229	6.003391	5.145804
2	-45.06699	224.5055	4.54e-08	2.942490	5.644668*	4.036694
3	51.56864	151.5853*	1.84e-08*	2.008458*	5.971652	3.613290*
4	97.57947	65.85863	2.09e-08	2.067069	7.291280	4.182530

Notes: * indicates lag order selected by the criterion; LR: sequential modified LR test statistic (each test at 5% level); FPE: final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion.

Source: Authors' compilation from EViews 10.

Figure 2 presents the inverse roots of AR characteristic polynomial of VAR (3), indicating no root lies outside the unit circle and hence VAR (3) satisfies the stability condition.



Source: Authors' compilation from EViews 10.

Figure 2 Inverse Roots of AR Characteristic Polynomial

Table 17 presents the results for the pairwise Granger Causality tests for the second sample period, which is from February 2009 to December 2017 with the proper lag order of 3. The results suggest that, at 10% significant level, we cannot reject the hypothesis that house price growth does not Granger cause DLNLAND (p-value = 0.1069) but we do reject the hypothesis that DLNLAND does not Granger cause house price growth (p-value = 0.0680). Therefore, it appears that Granger causality runs one-way from DLNLAND to house price growth and not the other way. In addition, since the p-values of DGDPGROWTH (p-value = 1.E-07), DCPI (p-value = 0.0050) and DM2GROWTH (p-value = 3.E-06) are so low, then we can say that the coefficients of

these variables in the model with GDPGROWTH as the dependent variable are not equal to zero and so they affect the future performance of house price growth. Therefore, it can be concluded that Granger causality does run between DGDPGROWTH, DCPI, DM2GROWTH and house price growth in both ways. Moreover, the results reveal that DINTEREST (p-value = 0.4015) and DSHARES (p-value = 0.7650) do not Granger cause house price growth.

Table 17 Pairwise Granger Causality Tests

Sample: 2009M02 2017M12
Lags: 3

Null hypothesis:	Obs	F-statistic	*p*-value
DGDPGROWTH does not Granger cause HPGROWTH	103	13.9955	1.E-07
HPGROWTH does not Granger cause DGDPGROWTH		3.95769	0.0104
DCPI does not Granger cause HPGROWTH	103	4.54949	0.0050
HPGROWTH does not Granger cause DCPI		3.59048	0.0165
DM2GROWTH does not Granger cause HPGROWTH	103	10.8524	3.E-06
HPGROWTH does not Granger cause DM2GROWTH		3.30195	0.0236
DINTEREST does not Granger cause HPGROWTH	103	0.98875	0.4015
HPGROWTH does not Granger cause DINTEREST		0.06934	0.9761
DLNLAND does not Granger cause HPGROWTH	103	2.45305	0.0680
HPGROWTH does not Granger cause DLNLAND		2.08751	0.1069
DSHARES does not Granger cause HPGROWTH	103	0.38373	0.7650
HPGROWTH does not Granger cause DSHARES		0.17605	0.9124

Source: Authors' compilation from EViews 10.

Table 18 Estimations for Period Two

Dependent variable: HPGROWTH
Method: least squares
Sample (adjusted): 2009M06 2017M12
Included observations: 103 after adjustments

Variable	Coefficient	Std. error	*t*-statistic	*p*-value
HPGROWTH(-1)	0.124545	0.126405	0.985287	0.3274
HPGROWTH(-2)	-0.407929	0.120174	-3.394494	0.0011
HPGROWTH(-3)	0.213813	0.121795	1.755507	0.0830
DGDPGROWTH(-1)	-0.236952	0.083748	-2.829323	0.0059
DGDPGROWTH(-2)	-0.171728	0.077292	-2.221808	0.0291
DGDPGROWTH(-3)	-0.068463	0.090447	-0.756946	0.4513
DCPI(-1)	-1.19E-05	0.006478	-0.001832	0.9985
DCPI(-2)	0.016632	0.006505	2.556710	0.0124
DCPI(-3)	-0.000751	0.006439	-0.116622	0.9074
DM2GROWTH(-1)	0.762319	0.379679	2.007799	0.0480
DM2GROWTH(-2)	0.960094	0.438335	2.190318	0.0314
DM2GROWTH(-3)	0.485994	0.345062	1.408425	0.1628
DINTEREST(-1)	0.000265	0.003872	0.068539	0.9455
DINTEREST(-2)	0.001152	0.003807	0.302571	0.7630
DINTEREST(-3)	-0.001736	0.003901	-0.445051	0.6575
DLNLAND(-1)	0.014299	0.013621	1.049781	0.2969
DLNLAND(-2)	0.013234	0.015025	0.880782	0.3810
DLNLAND(-3)	-0.001149	0.012107	-0.094929	0.9246

DSHARES(-1)	-4.90E-06	2.54E-05	-0.192681	0.8477
DSHARES(-2)	2.27E-05	2.17E-05	1.047058	0.2982
DSHARES(-3)	-8.49E-06	2.62E-05	-0.323629	0.7471
C	0.002657	0.004046	0.656612	0.5133
R-squared	0.524602		Mean dependent var	0.005908
Adjusted R-squared	0.401350		S.D. dependent var	0.037713
S.E. of regression	0.029179		Akaike info criterion	-4.043820
Sum squared resid	0.068965		Schwarz criterion	-3.481063
Log likelihood	230.2567		Hannan-Quinn criter.	-3.815884
F-statistic	4.256353		Durbin-Watson stat	2.000658
Prob(F-statistic)	0.000001			

Source: Authors' compilation from EViews 10.

Table 18 shows the estimations for the period June 2009 to December 2017. The probability for the F-test is less than the 0.01 significance level [F-statistic = 4.256353, Prob(F-statistic) = 0.000001)], suggesting the data in this period provides sufficient evidence to conclude the regression model fits the data better than the model with no independent variables. The regression model accounts for 52% of the variance (R-squared = 0.524602). Specifically, the house price growth is very different from that in period one. The coefficient on house price growth for lag of two months is statistically highly significant at 1 percent level, and the coefficient for lag of three months is significant at the 10 percent level. This suggests that house price growth in period two is investor-led caused, rather than self-occupied-led. That is, in period two, from 2009 to 2017, housing was dominated by its financial attribute. This is consistent with the money supply growth variable. The positive coefficients on money supply growth are statistically significant at 5 percent level for lags of one and two months. A higher money supply growth leads to higher house price growth; this is particularly true since the expansionary monetary policy introduced at the end of 2008.

The setup in period 2 confirms that fundamentals are important. The negative coefficients on lagged GDP growth (as a proxy for income) for lags of one and two months are statistically significant. CPI seem less important. Only the coefficient for lag of two months is significant. The rest, real interest rate, land purchased, and shares trading volume do not affect house price growth in this setup.

3.5 Comparison

Table 19 Comparison between the Two Periods

Variables	Period one	Period two
HPGROWTH		✓
M2GROWTH		✓
GDPGROWTH	✓	✓
CPI	✓	✓
INTEREST		
LAND	✓	
SHARES	✓	

Source: Own construction.

In view of the variables here are in monthly data, which implies that relatively the frequency interval is not a long period, ignoring the lag order to see the impact on house price growth would also have some economic significance. Therefore, regardless of the lag order, as long as the variable is statistically significant at .01 or .05 level, we consider that the relevant variable has an impact on the house price growth and give it a tick as shown in Table 19. A few rough conclusions can be drawn.

First, the first row in Table 19 shows that the lagged growth rate of house price is not significant in period one, but significant in period two. That is to say, the lagged house price growth rate itself has no significant impact on the house price before 2009, but it has become one of the determinants of the growth rate of house price after the 2009 financial crisis. This assumption is based on common sense, because housing becomes necessity when people need the living function of housing. The fluctuation of house price in the past has a relatively small impact on the current housing demand, because the demand elasticity of housing at this time is not great. However, if people buy to invest or even speculate, then the demand elasticity of housing is relatively large at this time. Because investors or speculators can wait for what they think is the best time to enter the market, and the best time means they will pay more attention to the historical trend of house prices. That is to say, when a house is an investment, its historical price will have an impact on the current demand, thus affecting the current price. Therefore, the housing since 2009 is more used as an investment commodity, which means it shows its financial attribute.

The second row shows that the growth rate of money supply M2 is only significant in period 2, but not in period 1. This explanation can be combined with the property of housing commodities mentioned above and the four trillion plan implemented by the Chinese government at that time. Under the expectation of inflation and limited investment channels in China, a substantial amount of money flows into the housing market. People treat housing as an investment good, resulting in increased demand for housing. The loose monetary policy makes the housing demand to become effective, which in turn leads to higher house prices.

The third and fourth rows show that GDP and CPI are significant factors influencing the growth rate of house prices in both periods. This shows that economic fundamentals have been affecting China's housing market all the time. This is consistent with most of the research results. This paper uses GDP growth as a proxy for income growth. It makes sense in the case of China. Since China’s reform and opening up, people’s income has been growing, which partly explains why house prices have been rising.

Many studies have different views on the impact of interest rate on house prices, both in theory and empirics. The empirical results here show that the impact of interest rate on house-price growth rate is not significant. This is consistent with some research conclusions. For example, Bo Gao and Xianzhu Wang (2009) analyzed the effectiveness of monetary policy transmission mechanism in China’s real estate market by building a VAR model, using data from 2000 to 2007, through cointegration tests and an impulse response function. They found that raising real estate loan interest rate inhibited the direct financing of real estate development enterprises from banks but could not prevent developers from other sources of funding, such as managing mortgage

loans in their own name. Therefore, with the increase of real estate loans, raising the loan interest rate cannot effectively restrain the rise of house prices. This explains the insignificant impact of interest rate from the supply side of housing. From the perspective of demand for housing, the "six-wallet theory" or the "family bank" make the ratio of full payment in a lump sum in China very high. Therefore, interest rate adjustments may have little impact on house price fluctuations.

The last two rows show that both the land space purchased, and the stock trading volume are only significant in period one. Land space purchased and stock trading volume reflect China's two important markets: the land market and the stock market. In other words, before the financial crisis, the housing market was closely related to the land market and the stock market.

This paper suggests that the rise in house prices since 2009 is a monetary phenomenon. In general, the amount of land supply affects the land prices and thus house prices. However, when people expect the house price to continue to rise and regard the housing as an investment that can resist inflation and is low-risk and high return, then even if the decrease of the land supply leads to the rise of the land price, people's housing demand is not affected.

Similarly, the stock market usually influences the housing market through the wealth effect. The insignificant impact of stock trading volume on house price growth since 2009 means there was probably no wealth effect between these two markets. This may be so because the increase of money stock caused by the implementation of monetary policy, because of the 4 trillion- yuan plan in late 2008, increased wealth holding of the public, which made people invest more in the housing market. Therefore, housing market was not influenced by the stock market.

4. Summary and Conclusions

In summary, since the dual attributes of housing will not only affect the consumption behavior of households, but also affect the effect of the country's real estate regulation and control policies, it is very meaningful to identify the dominant attribute of the housing market in different periods. For this purpose, this paper first builds a theoretical framework considering China's economic, institutional, and social background based on the Arestis and Karakitsos (2010) contribution for the analysis of the determinants of house prices. Based on the housing model, this paper focuses on the variables of house price growth rate, GDP growth rate, Consumer Price Index, money supply growth rate, real interest rate, land purchased, and shares trading volume. Because housing is a rigid demand for owner-occupiers or first-time buyers, they do not pay as much attention to the past price of housing as investors or speculators than investors or speculators. Conversely, housing is an elastic demand for housing investors or speculators. They usually pay substantial attention to price changes and try to predict home price growth rate based on past house prices. Based on this fact, this paper assumes that it represents first-time buyers if past house prices do not have a significant impact on current house prices; otherwise, it stands for housing investors. Then based on this assumption, the empirical results from the structural breakpoint analysis, specifically by employing the VAR methodology and Chow test, suggests that based on the time series data of the national data for the period 2000:M03 to 2017:M12, there is a

statistically significant structural breakpoint in February 2009. Therefore, the whole sample was divided into two sub-samples, period one 2000:M03-2009:M01 and period two 2009:M2- 2017:M12. The subsequent analysis compares the empirical results between these two periods. According to the assumption made to distinguish first-time buyers and investors, the first VAR model suggests that in period one, people buy houses for self-occupation, rather than investment or speculation. This is particularly consistent with the situation when housing was no more a welfare item and instead it became a commercial good, which resulting a high demand for self-occupation. The rapid urbanization during the same period together led to a housing boom. Therefore, the housing boom in period one was driven by owner-occupied housing demand. The monetary variables, money supply growth and real interest rate are not statistically significant, which confirms that housing in this period was dominated by its consumption attribute. On the other hand, the second VAR model suggests that house price growth in period two is investor-led caused, rather than self-occupied-led. This is consistent with the positive correlation between the variables of money supply growth and house price growth; this is particularly true since the expansionary monetary policy introduced at the end of 2008. Therefore, this paper suggests that the rise in house prices since 2009 is a monetary phenomenon, driven by its financial attribute. The comparison of the setup in two periods gives interpretations, which are of important economic significance. Although the results may be limited by the issues of causality and omitted variable bias, they are outweighed by the strengths of the VAR methodology employed. This paper fills the gap in the current research on the dominant attribute of China's housing market in the period from the early stage of fully housing marketization to the period before 2018, when China’s housing market was substantially regulated.

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