https://doi.org/10.1016/j.cities.2017.01.006

How does housing price affect consumption in China: Wealth effect or substitution effect?

Zhaoyingzi Dong [a,b,*], Eddie C.M. Hui [b], ShengHua Jia [a]

[a] Department of Business Administration, Zhejiang University, Zhejiang, China [b] Department of Building and Real Estate, The Hong Kong Polytechnic University, Hong Kong, China

* Corresponding author at: ZS710, Dept. of Building and Real Estate, The Hong Kong Polytechnic University, Hong Kong, China.

E-mail addresses: sdundzyz@163.com (Z. Dong), bscmhui@polyu.edu.hk (E.C.M. Hui), jsh@zju.edu.cn (S. Jia).

a b s t r a c t

This study investigates the asymmetric effects of housing price on consumption in 35 major Chinese cities, having regard to heterogeneity of the housing and financial markets. Unlike previous studies, this study employs the threshold regression model in analyzing the two important effects: namely wealth effect and substitution effect. The findings suggest that both markets (and their status) are vital to explain the linkage between housing price and consumption. In particular, for the regime where the housing price-to-income ratio is below 5.0882 and the indicator of financial development is above 1.8827, the wealth effect is significant. By contrast, for the regime where the housing price-to-income ratio lies between 5.0882 and 5.9625, the substitution effect will become dominant. This study provides a better understanding of the thresholds and transmission channels through which housing price affects consumption. That is largely ignored in the existing literature. On the other hand, the study offers meaningful implications for policy makers in formulating relevant measures that transfers housing wealth into consumption, with a view to developing a healthier and more stable housing market and bolstering better economic development in China.

Keywords:
Housing market
Financial market
Housing price
Consumption
Threshold regressive model

1. Introduction

Since the housing market reform in 1998, China's housing market has gone through a period of rapid development and housing prices have increased at an alarming speed. According to the data of National Bureau of Statistics of China, the average urban housing price rose from 2112 Yuan in 2000 to 6324 Yuan in 2014. Over the same period, another phenomenon which has drawn greater attention from both scholars and politicians is the continuous decline in consumption rate, from 46.9% in 2000 to 37.9% in 2014. By contrast, the country's consumption rate is much lower than the world's average level, i.e. 63.9% in 2014.[1] Given the sharp contrast in trends between consumption rate and housing price, some scholars raised a question: does the rise in housing prices suppress consumption? It is this essential question that motivates this study.

As a major component of household wealth, housing asset exerts a significant impact on consumption, which in turn drives the development of an economy (Hui, Ng, & Lau, 2011; Zhang, Li, Chen, & Li, 2016). Obviously, it is extremely important to have a deeper understanding of the effect of housing price on consumption and its transmission mechanisms, so scholars can have a better picture of the linkage between the real estate market and consumers' decisions and behaviors. Furthermore, with such knowledge, the Chinese government can enact more appropriate policies to strike a better balance between housing and consumer markets, with a view to achieving a more sustainable economic growth.

In academia, the effect of housing price on consumption has been widely discussed. The theoretical literature proposes some hypotheses on how consumption responds to fluctuation in housing prices. A rise in housing prices may boost consumption by increasing households' wealth or easing their credit constraint, which is called wealth effect; On the other hand, a rise in housing price can exert a negative effect on households' expenditure by increasing their cost of housing services and shrinking their budget, namely substitution effect. Among numerous studies, it is widely accepted that housing assets show wealth effects in developed countries. However, the results are quite mixed in China. The majority of Chinese scholars interested in this area find that housing price may suppress consumption, indicating housing assets show a substitution effect (Bussiere, Kalantzis, Lafarguette, & Sicular, 2013; Chamon & Prasad, 2010; Cheng & Huang, 2013).

Why do the studies based on China and developed countries show different results? Many scholars attempt to answer this question from different angles of view, including sex ratios, bequest motive, consumption habit, pension choice and ideas and so on (Wei & Zhang, 2009; Cheng & Huang, 2013; Li & Chen, 2014). Apart from the different cultural traditions and consumption concepts in China, there is another factor which has been ignored by Chinese scholars: that is market conditions. As China is going through rapid social and economic transformation, its market condition is largely different from that of developed countries. Specifically, China is facing regional disparities like uneven economic development and structure. In terms of finance and housing, regional differences are extremely obvious. In order to obtain a better political achievements, the local government in each region tries to reallocate capital from less productive regions to more productive ones systematically (Boyreau-Debray, 2003), leading to serious financial market segmentation and regional barriers. Moreover, due to heterogeneous labor mobility, economic development, real estate policy, people's expectation of future return and various other factors in different regions, there are huge differences in housing markets across cities in China (Liang & Gao, 2007; Gao, Chen, & Zou, 2012; Zhang et al., 2016).

Chinese scholars have already found evidence that the relation between housing price and consumption varies from region to region (Chen, Chen and Chou, 2010; Zang, Lv, & Warren, 2015). These phenomena raise one question: is it possible that the effect of housing price on consumption can be affected by the financial and housing markets in China? To address this problem, this study aims to explore the asymmetric effects of housing price on consumption, with emphasis on the

heterogeneity of housing market situations and financial market liberalization. The study will investigate 35 major Chinese cities during the period of 2003 to 2014. Furthermore, instead of setting exogenous and self-constructed criteria to split the sample and do regression, we employ the threshold regression model to determine the sample partition criteria endogenously, which is much more objective and unbiased.

The remaining of the paper is set out as follows: Section 2 gives a brief literature review and discusses how the financial and housing markets affect the relationship between the housing price and consumption. Section 3 introduces basic model and data resources. Section 4 presents the empirical analysis and main findings. Finally, we draw a conclusion in Section 5.

2. Literature review and hypothesis development

2.1. Literature review

In academia, the effect of housing price on consumption is not fully understood. Traditionally, several hypotheses have been proposed to explain how the change in housing prices affects consumption. First, an increase in housing prices lead to an improvement in net housing wealth for house owners and then raise their consumption, which is called wealth effect. Previous studies have provided us two major reasons why house assets cause wealth effects. One of them is liquidity constraints: an increase in housing prices will result in a higher collateral wealth. This in turn leads to a relaxation of credit constraint, so it enables credit-constrained homeowners to consume more. Another reason is precautionary saving: a higher housing wealth will reduce households' need for precautionary savings and lead to an increase in consumption. On the other hand, substitution effects are also identified in previous literature. The rationale behind it is that when the housing price rises, the costs of purchasing and renting house will increase, so people need to save more and consume less to pay for the down payments and future loan repayments. Moreover, the interaction between housing price and consumption may be driven by some unobserved common factors like economic development, technological progress, etc. For example, technological progress facilitates the development of the economy, raise the income levels, and increase the housing demand and consumption simultaneously. In a nutshell, the effect of housing assets on consumption is ambiguous. The wealth effect of increasing housing wealth may be partly offset by the higher cost of housing services. Therefore, how consumption responds to the changes in housing price depends on the net effect of the foresaid mechanisms.

The results of empirical studies do not reach a consensus either. Some scholars support that housing assets have a wealth effect (Giuliodori, 2005; Bostic, Gabriel and Painter, 2009; Hui, Zheng, & Zuo, 2012). Others argue that an increase in housing prices will suppress households' demand on other goods (Sheiner, 1995; Attanasio, Blow, Hamilton, & Leicester, 2009; Li, Li, & Chen, 2014; Chen & Huang, 2013). With a deeper understanding of the mechanisms and improvement of data availability, recent studies have focused more on the asymmetric effects of housing price on consumption. Some scholars discover an interesting heterogeneity in the effect of housing wealth across different households' attributes, including age structure (Campbell & Cocco, 2007), credit constraint (Gan, 2010), income level (Khalifa, Seck, & Tobing, 2013), holding situation of family assets (Calcagno, Fornero, & Rossi, 2009), etc.

In academia, there is no doubt that market conditions affect housing price (Hui & Wang, 2014). Moreover, some scholars have already discussed the role of market condition in the relationship between housing price and consumption. For example, Catte, Girouard, Price, and André (2004) suggest that the marginal propensity to consume out of housing wealth is different from country to country due to various financial structures and home ownership rate. Browning, Gørtz, and Leth-Petersen (2013) find no significant effect of housing price on consumption before the financial reform in Denmark, but a significant housing wealth effect among younger households after the reform. Using a panel data of fourteen emerging economies, Peltonen, Sousa and Vansteenkiste (2012) argue that the housing wealth effect and financial wealth effect are related to development of the financial market.

Previous studies have offered significant insights for further studies. However, those scholars who explore the asymmetric effects of housing price on household expenditure focus mainly on how the intensity of the effect differs in terms of heterogeneity of households. Though some scholars have already discussed the role of the financial market, only a few of them notice the importance of the status of the housing market, especially in China. However, it is no doubt that the effect of housing price on consumption is closely related to the functioning of the housing market. Furthermore, the majority of studies that investigate the role of market condition use country-level data, which are subject to measurement errors. First, scholars may attribute the different effects of housing price on consumption to the degree of financial development of a certain country. Nevertheless, different results may be derived from various consumption concepts and cultural traditions among people in different countries, which can hardly be observed in the data sets. Thus, these unobserved characteristics may lead to problems like omitted variable bias. In order to fill in such knowledge gap, this paper aims to explore the asymmetric effects of housing price on consumption, having regard to heterogeneity of housing market situation and financial market liberalization in 35 major Chinese cities. As the regional barriers and capital market segmentation still exist in China, the mobility of capital is much lower within China than within countries that have integrated international financial markets. Thus, the current financial market situation of each city in China is quite different. It is this financial asymmetry that this study aims to look at. Not only can using city-level data capture the differences in regional financial markets, but it can also allow us to have a better control over unobserved characteristics among people across the nation. Second, there are many studies using the country-level data to estimate the elasticity of consumption to housing price, the differences in elasticity between countries, etc. Their studies may at best yield probable analytic results. Yet they have rarely explored what actually leads to the heterogeneous relationship between housing price and household expenditure. To address such underlying shortcomings and provide more objective and unbiased evidence, this study is distinct from traditional studies in two ways. First, we use threshold regression to determine sample partition criteria endogenously. Second, we investigate the effect of housing price on consumption across different regimes.

2.2. Housing price, consumption and housing market

The strength of each transmission channel from housing price to household consumption may be affected by the status of the housing market and the level of housing price. First, when housing price is relatively low, a large number of households are still credit-constrained due to low housing wealth. Thus, the collateral effect of housing wealth is more significant since these households' credit constraints can be greatly relieved as housing price rises. Second, because of the diminishing marginal propensity of consumption out of wealth, the housing wealth effect is likely to decrease along with the increasing housing price. Third, if the housing price-to-income ratio is too high and the housing market is distorted, housing affordability will be reduced, leading to a lower home-ownership rate and redistribution of housing wealth (Catte et al., 2004). As a result, the housing wealth effect is reduced. Hence, we have the following hypothesis:

H1. When the housing market is healthy and housing price is affordable, the wealth effect is dominant. When the housing market is unhealthy and the housing price is excessively high, the substitution effect dominates.

2.3. Housing price, consumption and financial market

The liberalization and development of a financial market affect the relative power of the transmission channels discussed above (Chamon & Prasad, 2010; Caporale & Sousa, 2016; Case, Quigley, & Shiller, 2013). First, for households who want to buy a new house, a more competitive and developed financial market provides more mortgage products available to households and serves for a wider range of borrowers with a lower interest rate, leading to a lower down payment and higher home ownership rate. Thus, housing wealth effect is more significant. Second, a more developed financial market reduces market frictions and transaction costs. Therefore, it is more likely that households withdraw their home equity by way of selling (in full or in part) their house for consumption as housing assets become more liquid (Sierminska & Takhtamanova, 2012). Consequently, such a gain results in an increase in household consumption. Finally, when housing price increases, households may want to borrow against their increasing housing wealth. A developed financial market is more likely to support such a wish for loans by offering more financial products and lending channels. If the financial system cannot offer ways for refinancing, households may not be able to react to increasing housing prices (Ludwig & Sløk, 2002). Thus, we propose the second hypothesis:

H2. Where a regional financial market is developed to a relatively high level, the wealth effect will be dominant. In other words, where a regional financial market is less developed, the substitution effect is dominant.

3. Data and model specification

3.1. Data sources

The data set of this paper covers 35 major cities[1] in China between 2003 and 2014. Using city-level data has several advantages: First, with one country data, we are able to have a better control over the unobserved characteristics across the whole country; Second, as China is going through a rapid social and economic transformation, the market conditions vary a lot from city to city. This enables us to capture the effect of the housing market and financial market simultaneously. Furthermore, the period 2003–2014 coincides with the private housing market boom, which is appropriate for the purpose of this study.

Unfortunately, there are no city-level data available to distinguish between homeowners' and renters' consumption, and between durable and non-durable consumption in China. However, as the aim of this study is to explore the net effect of housing price on total consumption though various transmission mechanisms at macro level, it is reasonable to use the per capita consumption expenditure of urban residents multiplied by the average family size of each city as a proxy for household consumption (cons).[2] Per capita consumption expenditure of urban residents refers to daily spending, including all spending of households except for borrowing. Specifically, it includes expenditure on food, clothing, residence, transportation, family equipment, communication, education and entertainment, health care, etc. The residence expenditure here includes spending on heating, water and electricity, property management, etc., but excludes expenditure on buying or constructing a house and imputed rent of owner occupied housing.[3] Thus, the household consumption we use in this paper does not include housing expenditure, which is appropriate for the estimation of the effect of housing on non-housing consumption.

The independent variable is housing price (hp), which is denoted by the average housing transaction price of each city. Typically, existing studies use housing price (Ludwig & Sløk, 2002; Campbell & Cocco, 2007) or housing wealth (Case, Quigley, & Shiller, 2001) to estimate the effect of housing on consumption. However, since there are no housing wealth data available at city level in China, this study can only investigate the response of consumption to changing housing price.[4] Note that some other Chinese scholars also use housing price to explore the impact of housing on consumption (Li, Li, & Chen, 2013; Kuang, 2011).

For other control variables, household saving (saving) is equal to per capita saving multiplied by family size of each city, while household income (inc) is denoted by per capita annual disposable income multiplied by family size of each city. All the data above are from the "China city statistical year book in 2003–2014". In order to remove the effect of inflation, the nominal value of household consumption, urban housing price and other variables are converted into real values by using the CPI of each city with 2003 as the base year.

In terms of threshold variables, we use the ratio of housing price to income as a proxy variable to the "affordability" status of housing market (rem), and the ratio of deposit of financial institutions to GDP as a proxy variable to the regional financial development (fd). Housing price to income ratio is the total cost/price of a home relative to annual income of households. As an important index of affordability, it includes a large amount of information for certain housing markets and reflects market distortions to some extent (Green & Malpezzi, 2003; Moser, Gatehouse, & Garcia, 1996). For households, this ratio connects asset price and household earning, reflecting fluctuations of the housing market. For policy makers, this index is not only an important indicator that can evaluate the effectiveness of real estate policy, but also a reflection of the national economic operation (Renaud, 1989).

Previous studies offer no universal rule of measurement of financial development, nor are there comprehensive and comparable data available across cities. Hence scholars have employed several indices to measure the level of financial market development, including financial market structure, financial depth, financial development scale, liquid liabilities of financial system, etc. Given the availability of data at city level in China, we use financial depth, which is defined as the ratio of total financial assets to GDP (Goldsmith, 1969), to measure the level of regional financial development of each of the cities under investigation. This measurement captures the size of the financial sector in relation to the economy, which has a significant effect on economic growth. On the other hand, some scholars use the ratio of credit provided by financial intermediaries to GDP (World Bank, 2012; Calderón & Liu, 2003; Levine, 1999) to measure financial depth. However, as Ljungwall and Li (2007) argue, the credits of financial institutions may be affected by the government's credit policy, in particular, in China. Moreover, the size of deposit is largely based on economic participants' own decisions. In view of this, we use the ratio of deposit of financial institutions to GDP of each city to denote the level of financial development (Hassan, Sanchez, & Yu, 2011; Ljungwall & Li, 2007; Rajan & Zingales, 2003). Not only can this ratio reveal the role of the financial institutions

[1] Specifically, 35 major cities includes Beijing, Tianjin, Shijiazhuang, Taiyuan, Hohhot, Shanghai, Hangzhou, Nanjing, Ningbo, Qingdao, Xiamen, Jinan, Fuzhou, Guangzhou, Shenzhen, Nanning, Haikou, Hefei, Changsha, Zhengzhou, Wuhan, Nanchang, Chongqing, Chengdu, Xian, Kunming, Xining, Lanzhou, Guiyang, Yinchuan, Urumqi, Shenyang, Dalian, Changchun and Harbin.

[2] Note that a number of other researchers also adopt total consumer expenditure (Case, Quigley, & Shiller, 2001; Chen, 2006).

[3] In China, there are two statistical caliber about residence expenditure. One is based on China's national household survey, which is the residence expenditure we refer in this paper. The other one is based on GDP preventive expenditure approach, which includes the expenditure on buying or constructing a house and virtual rent of owner occupied housing.

[4] Note that average housing price is different from real housing price. The former is the average of housing prices and housing qualities such as locations and house types. However, restricted by the data unavailability, we use the average residential housing selling prices as a proxy for housing price as other Chinese scholars do (Li, Li, & Chen, 2013; Kuang, 2011).

in the economy (Levine, 2005), but it can also evaluate the ability of financial institutions to attract savings (Rajan & Zingales, 2003; Giuliano & Ruiz-Arranz, 2009). Generally speaking, the ratio of savings to GDP is beneficial to financial development (Hassan et al., 2011).

The definitions and descriptive statistics of the variables are shown in Table 1.

To get a comprehensive understanding of the market condition between cities, we compare rem and fd between first-tier cities (Beijing, Shanghai, Guangzhou, Shenzhen) and other cities. The mean of rem and fd and the growth rates of rem (rem%) and fd (fd%)of the two categories of cities in each year are shown in Table 2. It shows that the average values of rem and fd of first-tier cities are higher during the whole period than those of none-first-tier cities. Furthermore, these two ratios were on the rise overall. It can be observed in Table 2 that rem, especially that of none-first-tier cities, increased faster during the period 2008–2010 than in other periods; however, the trends of rem decreased in 2011. Furthermore, fd rose faster from 2008 to 2009.This substantial rise may be due to the four trillion investment plan issued by the Chinese government in November 2008 and the development of shadow banking in China after the financial crisis.

3.2. Estimation model

To begin with, we set the estimated consumption as a function of income, housing price and financial wealth. The model is shown as follows:

$$lncons_{it} = u_i + \beta_1 lnhp_{it} + \beta_2 lninc_{it} + \beta_3 lnsaving_{it} + \varepsilon_{it} \quad (1)$$

The subscripts i and t denote the city and time respectively.lnhp is a proxy for housing price in logarithmic form. lncons, lninc and lnsaving denote household consumption, income and saving in logarithmic form, respectively. In order to test the asymmetric effects of housing price on consumption in different market conditions, we implement the threshold regression estimation method developed by Hansen (1999). This method is designed for panel-data with fixed effects,

Table 1
Variable definitions and summary statistics.

Variable	Definition	Mean	Std.	Min	Max
cons	Household annual consumption expenditure	44,362.43	18,752.17	17,827.29	121,186.5
hp	Housing price	5738.929	3742.442	1324	24,723
inc	Household annual disposable income	62,132.28	28,327.64	23,723.78	162,090.8
saving	Household saving	143,181.2	144,123.1	18,514.38	1,092,682
rem	Housing price-to-income ratio	6.902871	2.472169	3.180963	17.07258
fd	Deposit of financial institutions to gdp ratio	2.078783	0.6691537	0.989485	4.5668

Table 2
Comparison of market condition between first- and second-tier cities.

	First-tier city		None-first-tier city		First-tier city		None-first-tier city	
	rem	rem%	rem	rem%	fd	fd%	fd	fd%
2003	5.01	–	4.71	–	2.61	–	1.89	–
2004	5.22	4.19%	4.84	2.84%	2.51	−3.82%	1.88	−0.84%
2005	5.90	13.06%	5.31	9.72%	2.59	3.06%	1.87	−0.10%
2006	6.50	10.09%	5.42	1.92%	2.55	−1.50%	1.86	−0.73%
2007	8.20	26.24%	6.01	11.02%	2.46	−3.57%	1.81	−2.44%
2008	9.31	13.43%	6.32	5.01%	2.51	2.17%	1.85	1.72%
2009	10.28	10.45%	7.20	14.02%	2.95	17.56%	2.15	16.55%
2010	12.22	18.92%	8.14	13.02%	2.95	0.01%	2.19	1.87%
2011	11.06	−9.53%	8.27	1.56%	2.85	−3.41%	2.04	−6.98%
2012	10.11	−8.56%	7.99	−3.36%	2.92	2.24%	2.08	2.08%
2013	11.00	8.78%	7.86	−1.61%	2.92	0.00%	2.16	3.92%
2014	11.40	3.64%	7.75	−1.45%	2.89	−0.73%	2.16	−0.08%

which has several advantages. First, as discussed earlier, the relation between housing price and consumption is possibly driven by some common factors, e.g., technology innovation and future income expectation, which may lead to omitted variable bias. Thus, by using a fixed effect model, we can have a better control over unobserved omitted variables. Second, unlike previous studies which use exogenous and subjective criteria to partition a sample (Peltonen et al., 2012) or just make a comparison between the analytic results of different countries (Catte et al., 2004) and different times within one country (Browning, Gortz, & Leth-Petersen, 2008), this study implements the threshold regression estimation method which enables the data to reveal a cut-off point for proper analysis. In other words, this method is able to determine the criteria endogenously, which is more objective and unbiased. The single threshold model can be written as follows:

$$y_{it} = u_i + \beta_{01} x_{it} + \varepsilon_{it}; \text{ if } q_{it} \le \gamma \qquad (2) \quad y_{it} = u_i + \beta_{02} x_{it} + \varepsilon_{it}; \text{ if } q_{it} > \gamma;$$

where q_{it} is the threshold variable, y_{it} is the dependent variable,x_{it} is the independent variable, and γ is the estimated threshold parameter. The two equations can be merged into:

$$y_{it} = u_i + \beta_{01} x_{it} \cdot 1(q_{it} \le \gamma) + \beta_{02} x_{it} \cdot 1(q_{it} > \gamma) + \varepsilon_{it}; \quad (3)$$

where 1(·) is the indicator function. Two regimes are set according to the estimated threshold parameter. In regime 1, where $q_{it} \le \gamma$, the estimated coefficient of x_{it} is β_1'; In regime 2, where $q_{it} > \gamma$, the estimated coefficient of x_{it} is β_2'. Similarly, we define the threshold model as follows:

$$y_{it} = \mu_i + \beta_{01} x_{it} \cdot 1(q_{it} \le \gamma_1) + \beta_{01} x_{it} \cdot 1(\gamma_1 < q_{it} \le \gamma_2) + \beta_{02} x_{it} \cdot 1(q_{it} > \gamma_2) + \delta + \varepsilon_{it}, \quad (4)$$

where γ_1 and γ_2 are the two estimated threshold parameters. Considering the effect of the heterogeneity of housing market and financial market in different cities, we denote the ratio of housing price-to-income (rem) and the ratio of deposit to GDP (fd) as threshold variables. The

Table 3
Unit test of dependent and independent variables.

	Level-value equation			First differenced equation		
Variables	LLC	IPS	Fisher-ADF	LLC	IPS	Fisher-ADF
lncons	−3.7926*** (0.0001)	−0.0253 (0.4899)	99.9783** (0.0108)	−16.1775*** (0.0000)	−4.4301*** (0.0000)	144.5937*** (0.0000)
lninc	−0.7207 (0.2355)	0.3464 (0.6355)	68.5639 (0.5262)	−4.8963*** (0.0000)	−3.1340*** (0.0009)	114.4330*** (0.0006)
lnhp	−0.4014 (0.6559)	−0.4105 (0.3407)	73.7527 (0.3565)	−12.7752*** (0.0000)	−3.5064*** (0.0002)	126.4104*** (0.0000)
lnsaving	1.5204 (0.9358)	0.2524 (0.5996)	80.9693 (0.1740)	−4.3744*** (0.0000)	−2.6212*** (0.0044)	217.2843*** (0.0000)

Notes: *** and ** denote statistical significance at the 1% and 5% levels respectively.

threshold model is then given by:

$$\ln cons_{it} = \begin{array}{l} +\beta_{11}^{1} \ln hp_{it} \cdot 1(\boldsymbol{rem_{it}} \le \boldsymbol{\gamma}^{1}) + \beta_{12}^{1} \ln hp_{it} \cdot 1 \\ \beta_{2}^{1} \ln inc_{it} \quad \beta_{3}^{1} \ln saving_{it} \end{array} \quad \mu^{1}{}_{i} rem_{it} > \gamma^{1} + \quad + \quad + \quad \delta^{5} +$$

$$\ln cons_{it} = \begin{array}{l} +\beta_{11}^{2} \ln hp_{it} \cdot 1(\boldsymbol{fd_{it}} \le \boldsymbol{\gamma}^{2}) + \beta_{12}^{2} \ln hp_{it} \cdot 1 \\ \beta_{2}^{2} \ln inc_{it} \quad \beta_{3}^{2} \ln saving_{it} \end{array} \quad \mu^{2}{}_{i} fd_{it} > \gamma^{2}$$

$$+ \quad + \quad \delta^{5} +$$

Eq. (5) means that when rem is smaller than the estimated threshold value γ^1, the elasticity of consumption to housing price is $\beta^1{}_{11}$; while if rem is larger than the estimated threshold value γ^1, the elasticity of consumption to housing price is $\beta^1{}_{12}$. Eq. (6) means that when fd is smaller than the estimated threshold value γ^2, the elasticity of consumption to housing price is $\beta^2{}_{11}$; while if fd is larger than the estimated threshold value γ^2, the elasticity of consumption to housing price is $\beta^2{}_{12}$. Similarly, we can build double and triple threshold models on the basis of the equations above.

4. Empirical analysis

4.1. Unit root test

In order to avoid spurious regression problems, we first undertake unit root test on all variables using homogeneous panels LLC, heterogeneous panel LPS, and Fisher-ADF methods. Table 3 shows that all the variables are stationary for all three tests of LLC and Fisher-ADF at the level of I(1). Hence we use the differenced value of first order of all variables in the model.

Table 4 shows that rem and fd are already stationary series in terms of all unit root test. Thus, rem and fd meet the requirements of threshold variables.

Table 4
Unit test of threshold variable.

Variable	LLC	IPS	Fisher-ADF
rem	−7.2566*** (0.0000)	2.9906** (0.0014)	211.6374*** (0.0000)
fd	−6.6889*** (0.0000)	−2.0123** (0.0221)	112.4969*** (0.0010)

Notes: *** and ** denote statistical significance at the 1% and 5% levels respectively.

Table 5 Threshold effect test.

	rem		fd	
Threshold	F-value	P-value	F-value	P-value
Single	5.11	0.2520	44.15	0.0000***
Double	9.17**	0.0340**	6.09	0.2200

[5] In fact, we added temporal factors in all the regression model, including the analysis in Sections 4.3, 4.4 and 4.5, in this paper at first. However, after doing a Wald test to test significance of the temporal effect, we find that the P-values are larger than 0.1, which indicates there are no temporal effect. The So we use the model without temporal factors in the paper.

Triple	6.77	0.5200	9.48	0.6400

4.2. Threshold effect test

To decide the number of thresholds of rem and fd, the fixed effect model is estimated under the hypothesis of zero, one and two thresholds. Table 5 shows that threshold variable rem has two thresholds, while fd has one threshold.

The point and confidence interval estimations of the threshold are shown in Table 6. The two estimated threshold values of rem are 5.0882 and 5.9625, which split the sample into three regimes: the low rem regime, the middle rem regime and the high rem regime. The single threshold value of fd is 1.8827, which splits the sample into two regimes: the low-level financial development regime and the high-level financial development regime.

Based on the estimation above, we rewrite Eqs. (5) and (6) with threshold variables as follows:

$$\Delta \ln cons_{it} = u_i + \beta_{11}^{1}\Delta \ln hp_{it}\cdot 1(rem_{it} \le 5.0882) + \beta_{12}^{1}\Delta \ln hp_{it}\cdot 1(rem_{it} > 5.0882) + \beta_{2}\Delta \ln inc_{it} + \beta_{3}^{1}\Delta \ln saving_{it} + \varepsilon_{it} \quad (7)$$

$$\Delta \ln cons_{it} = u_i + \beta_{11}^{2}\Delta \ln hp_{it}\cdot 1(fd_{it} \le 1.8827) + \beta_{12}^{2}\Delta \ln hp_{it}\cdot 1(fd_{it} > 1.8827) + \beta_{2}^{2}\Delta \ln inc_{it} + \beta_{3}^{2}\Delta \ln saving_{it} + \varepsilon_{it} \quad (8)$$

4.3. Threshold estimation results

For comparison, we first use a fixed effect model to test the relationship between housing price and consumption, without regard to the interaction between financial market and housing market. The insignificant coefficient shown in column (1) of Table 7[6] indicates that housing price has no significant effect on consumption as a whole if we do not distinguish different market conditions.

Then we use the threshold estimation identified by rem and fd to examine whether housing price affects consumption, having regard to housing market and financial market. As shown in column (2) of Table 7, the consumption shows asymmetric responses to housing price under different regimes in housing markets. In the relatively low housing price regime (rem ≤ 5.0882), housing price exerts a significant, positive effect on consumption. In the regime where rem lies between 5.0882and 5.9625, housing price has a significant, negative effect on consumption. In the regime where rem is larger than the threshold value 5.9625, the effect of housing price on consumption is insignificant. This is because the excessive housing price may make people give up owning a house and turn to other consumption goods (Engelhardt, 1996), which may ameliorate the negative effect of an increase in housing price on consumption.

Table 6
Threshold estimator (level = 95).

Variables	Model	Point estimation	Lower	Upper
rem	TH1	5.0882	5.0794	5.0899
	TH2	5.9625	5.9442	5.9667
fd	TH1	1.8827	1.8825	1.8863

Notes: 300 bootstrap replications are used for each of the three test; *** and ** denote statistical significance at the 1% and 5% levels respectively.

The estimation result in column (3) of Table 7 suggests that in different financial development regimes, the effect of on consumption is asymmetric. In the regime where the degree of financial development is low (fd ≤ 1.8827), the coefficient of housing price is positive but insignificant, indicating the housing price has no effect on consumption; In the regime where the financial development attains a relative high level (fd > 1.8827), an increase in housing prices has a positive and significant effect on consumption, suggesting that housing assets show a wealth effect. These asymmetric effects confirm the contribution of financial markets to the wealth effect of housing price on consumption.

4.4. Grouping regression

The analysis above has already shown that the housing and financial markets play a vital role in the transmission channels from changes in housing prices to consumption. Furthermore, this study will explore the combined effect of the financial and housing markets in the relationship between housing price and consumption. Particularly, this section will address whether the shortcomings of less developed financial markets can be offset by the proper functioning of the housing market, or whether the negative effect brought by the excessive housing price can be relieved by a higher degree of financial development. For this purpose, we spilt the whole sample into six regimes on the basis of the threshold value estimation, and apply fixed effect regression for each regime.

From Table 8, the coefficient of Δlnhp in the regime (rem ≤ 5.0882 and fd > 1.8827) is significantly positive, while the coefficient of Δlnhp in the regime (rem > 5.9625 and fd ≤ 1.8827) is significantly negative, i.e., when the housing market is healthy and affordable and the financial market is well developed, housing assets have significant wealth effects.

Table 7

Fixed effect and threshold regression results.

	Fixed effect (1)	Double threshold rem (2)	of fd (3)	Single threshold model	model in terms of	model in terms
hp	(0.267)					
$\Delta\ln hp$ $(rem_{it} \leq 5.0882)$		0.094*			Δln	0.028
		(0.053)				
Δlnhp (5.0882brem≤ 5.965)		−0.151***				
		(0.028)				
Δlnhp (rem_{it}N5.9625)		0.027				
		(0.141)				
Δlnhp (fd ≤ 1.8827)			−0.034			
			(0.349)			
Δlnhp (fd N 1.8827)			0.078**			
			(0.017)			
Δlninc	0.736***	0.716***	0.719***			
	(0.000)	(0.000)	(0.000)			
Δlnsaving	−0.017	−0.013	−0.025			
	(0.518)	(0.625)	(0.339)			
Constant	0.096*	0.010*	0.010**			
	(0.097)	(0.076)	(0.078)			
r_2	0.271	0.291	0.282			
N	385	385	385			
F	42,956	28.253	34.055			
P	0.000	0.000	0.000			

Notes: ***, **, and *denote statistical significance at the 1%, 5% and 10% levels respectively.

If both markets behave to the contrary, housing asset will have significant substitution effects.

In the other four regimes, the coefficient of Δlnhp is insignificant. Nevertheless, by comparing the coefficients of housing price in those regimes, we can still find that the financial and housing markets play some role in the interaction between housing price and consumption. Fixing rem at a certain level, the coefficient of Δlnhp tends to be positive in the regimes where the financial market develops at the high level (fd N 1.8827). This somehow indicates that the negative effect brought by the distorted and excessive housing price can be offset by a higher level of development of the financial market. Fixing financial development at the high level (fd N 1.8827), the coefficient of Δlnhp is positive, but the value become smaller as rem increases. Fixing financial development at the low level (fd b =1.8827), the coefficient of Δlnhp in the regime (rem ≤ 5.0882) is positive and significant, while the coefficient of Δlnhp in the other two regimes is insignificant. These results imply that the housing market is important to the relative power of substitution effect and wealth effect, even if the financial markets are in similar states of development.

Obviously, all results in Table 8 show that both housing and financial markets are significant to the transmission mechanisms from housing price to consumption. However, unlike previous studies which had put much emphasis on the role of financial market in the association between housing price and consumption, we find that the affordability status of the housing market is also instrumental in the way that housing assets exert a wealth effect in China.

4.5. Before and after 2009 comparison

In the previous two parts, we clearly see the significance of both financial and housing markets in the transmission channels from housing wealth to consumption, especially the condition of the housing market. In view of the previous analysis, we attempt to classify the 35 cities in terms of rem and fd.

The threshold regression results show that wealth effect is significant in the regime where rem is smaller than 5.0882. By contrast, the substitution effect is dominant in the regime where rem lies between 5.0882 and 5.9625. The estimated value corresponds to the reasonable range 4–6, as the World Bank suggests. In other words, we may consider the housing market to be somewhat healthy where rem is smaller than 5.0882andunhealthywhere rem is larger than 5.0882. We also categorize cities to be highly financial developed if fd is larger than 1.8827, and as less financial developed if fd is smaller than 1.8827 based on the threshold estimation results. After classifying each city into different categories at different times, we find that before 2009, most second-tier and third-tier cities were in a relative healthy housing market regime since their housing price-to-income ratios were within the reasonable and affordable range. By contrast, the first-tier and quasi-first-tier cities were in an unhealthy housing market regime. However, after 2009, almost all cities were in the unhealthy housing market category. The main reason for this structural change is that in November 2008, the Chinese government issued a four trillion investment plan, which had since caused a dramatic increase in housing prices in most cities in China. Furthermore, we find that the financial market of each city kept on developing as time goes by. Generally speaking, all the first-tier cities and the majority of quasi-first-tier cities were in the highly developed financial categories for all the time.

Thus, we suspect that the year 2009 may be a turning point for China's housing markets. Hence we conduct a fixed effect regression based on the data before and after 2009 to explore whether the effect of housing price on consumption has altered since 2009. Table 9 shows that the coefficient of Δlnhp is significant and positive in the sub-period 2003–2008, but is significant and negative in the subperiod 2009–2014. This suggests that the relative power of housing wealth effect and substitution effect has changed since 2009. Before 2009, the housing markets of major cities had operated healthily and

Table 8
Grouping estimation results.

Regime		(*rem* ≤ 5.0882) (1)	(5.0882 b rem ≤ 5.9625) (2)	(rem N 5.9625) (3)
			(fd ≤ 1.8827)	
	Δln*inc*		Δlnhp 0.200	
			(0.218)	(0.802)
	Δln*saving*		(0.034)	
			0.506**	0.162
			1.064***	
			(0.019)	(0.450)
			(0.002)	
	r^2		0.012 0.526***	
			(0.396)	(0.009)
			(0.206)	
			Constant	0.011 0.010
			0.003	
(*fd* > 1.8827)	Δln*hp*		(0.441)	(0.627)
			(0.870)	
	Δln*inc*		0.229	0.348 0.427
	Δln*saving*	0.120	N	43 38
			105	
	Constant	—	F 7.692	3.627 4.695 p 0.007 0.052 0.022
			0.299**	0.101 0.060
	r^2		(0.010)	(0.565)
	(0.347)			
			−0.032	−0.082**
				−0.101
				−0.123 −0.065
		0.763*** 0.855*** 0.497***	(0.000) (0.000) (0.007)	
		(0.287)	(0.344)	(0.477)
		0.013	0.001	0.028**
		(0.379)	(0.977)	(0.029)
		0.676	0.336	0.124
	N	34	34	131
	F	22.872	10.759	10.363
	p	0	0.002	0.001

Notes: *** and ** denote statistical significance at the 1% and 5% levels respectively.

the housing prices were relatively reasonable compared to the income level. In this case, an increase in housing prices could stimulate consumption. Nevertheless, since the housing prices of most major cities increased drastically in 2009, the excessive housing prices exert a negative effect on consumption. In all, the results illustrate that the affordability status of a housing market plays a vital role in the transmission mechanism that produces asymmetric effects on consumption.

5. Conclusion

Based on the data of 35 major Chinese cities during the period 2003–2014, this study uses threshold regression to explore the asymmetric effects of housing price on consumption, having regard to heterogeneity of housing markets and financial market liberalization. The threshold estimation results in the 2major findings, as follows.

First, both housing and financial markets are vital to the relationship between housing price and consumption. The wealth effect is significant in the healthy housing market regime where housing price-to-income ratio is smaller than 5.0882. By contrast, the substitution effect is dominant in the regime where housing price-to-income ratio lies between 5.0882 and 5.9625. The estimated value of a healthy housing market corresponds to the reasonable range 4–6, as the World Bank suggests. This also indicates that the majority of the housing markets in China

Table 9
Before and after 2009 regression.

Variable	2003– 2008	2009– 2014
Δlnhp	0.122**	−0.046**
	(0.02)	(0.018)
Δlninc	0.713***	0.520***
	(0.000)	(0.002)
Δlnsaving	−0.006	0.060
	(0.773)	(0.280)
Constant	−0.000	0.022**
	(0.984)	(0.025)
r2	0.298	0.165
N	175	210
F	77.545	6.459
p	0.000	0.004

Notes: *** and ** denote statistical significance at the 1% and 5% levels respectively.

do not operate very well and the housing prices are unaffordable for people in these cities. The threshold estimation of financial development shows that housing price has a wealth effect on consumption in the developed financial market regime where the deposit-to-GDP ratio is larger than 1.8827. It is true that most cities' financial markets keep on developing in the last decades, but the threshold value still suggests that the financial markets in some cities cannot provide enough channels and products for people to benefit from their increased housing wealth.

Second, in the estimation of the six regimes against different threshold values, our finding shows that the negative effect brought by excessive housing price can be relieved by a higher degree of financial development, while the shortcomings of less developed financial market can be offset by the proper functioning of the housing market. Furthermore, a turning point in China's housing markets occurred in 2009. Consequently, the impact of housing price on consumption has since altered. This suggests that housing assets exhibit a wealth effect before 2009, but a substitution effect after 2009. Although previous studies often put more emphasis on the role of the financial market, the housing market is indeed equally or even more important to the transmission channels from housing wealth to consumption in China.

This study contributes to existing knowledge in two ways. First, we focus on the role of market conditions (i.e. housing market and financial market) across cities within one country. This offers advantages over previous studies, not only because this study is the first one to examine the research issue at city level, but also because it can effectively avoid the problem of heterogeneous consumption across countries that previous studies have yet to solve (i.e. different consumption habits across different countries). Moreover, the role of market conditions has been ignored by many scholars in previous studies on China. Second, instead of setting exogenous and subjective criteria to split the sample (by urban housing price-to-income ratio and financial development and estimate the housing wealth effect), we implement the threshold regression model that decides the group criteria endogenously and explores the asymmetric effects of housing price on consumption, having regard to heterogeneity of housing market situations and the level of financial market liberalization, which is more objective and accurate.

Two main implications arise from our findings. First, the results indicate that the housing market is highly important to the association between housing price and consumption. Thus, the Chinese government should formulate appropriate real estate policies to ensure a healthy and stable development of the housing market, whereby the housing price can be kept at a reasonable and affordable level. If so, people are more likely to convert housing wealth into consumption. This could, in turn, accelerates economic development. Second, our findings confirm the vital role of the financial market in the transmission channels from housing wealth to consumption in China. However, the effect of the financial market in the country may not be as strong as that in developed countries due to lack of various mortgage financing channels and products. Thus, facilitating the development of the financial market and promoting innovation of financial products in China are of great importance to ensure that people can benefit from refinancing through home mortgages. This helps convert housing wealth into consumption. As a result, domestic demand is expanded and economic development is improved.

There is one limitation of this study. Using city-level data enables us to have a better control over the unobserved characteristics among households in the whole country, but it is not able to distinguish heterogeneity between them. However, the characteristics of households, such as credit conditions and risk attitudes, may affect their consumption function and ability to borrow from financing institutions. Furthermore, these differences will lead to a different response of consumption to housing prices under various market conditions. In the future, it might be worthwhile to study how households' consumption responds to changes in housing prices and investigate who benefits most from the changing housing wealth under different market conditions by using micro level data.

Acknowledgment

This study was funded by the Hong Kong Polytechnic University's research funding (Project No. G-SB50).

References

Attanasio, O. P., Blow, L., Hamilton, R., & Leicester, A. (2009). Booms and busts: Consumption, house prices and expectations. Economica, 76(301), 20–50.

Bostic, R., Gabriel, S., & Painter, G. (2009). Housing wealth, financial wealth, and consumption: New evidence from micro data. Regional Science and Urban Economics, 39(1), 79–89.

Boyreau-Debray, G. (2003). Financial intermediation and growth: Chinese style. World Bank Policy Research Working Paper, 3027.

Browning, M., Gortz, M., & Leth-Petersen, S. (2008). House Prices and Consumption: A Micro Study. University of Copenhagen, Mimeo.

Browning, M., Gørtz, M., & Leth-Petersen, S. (2013). Housing wealth and consumption: A micro panel study. The Economic Journal, 123(568), 401–428.

Bussiere, M., Kalantzis, Y., Lafarguette, R., & Sicular, T. (2013). Understanding household savings in China: The role of the housing market and borrowing constraints. MPRA Paper, 44611.

Calcagno, R., Fornero, E., & Rossi, M. C. (2009). The effect of house prices on household consumption in Italy. The Journal of Real Estate Finance and Economics, 39(3), 284–300.

Calderón, C., & Liu, L. (2003). The direction of causality between financial development and economic growth. Journal of Development Economics, 72(1), 321–334.

Campbell, J. Y., & Cocco, J. F. (2007). How do house prices affect consumption? Evidence from micro data. Journal of Monetary Economics, 54(3), 591–621.

Caporale, G. M., & Sousa, R. M. (2016). Consumption, wealth, stock and housing returns: Evidence from emerging markets. Research in International Business and Finance, 36, 562–578.

Case, K. E., Quigley, J. M., & Shiller, R. J. (2013). Wealth effects revisited: 1975–2012 (No. w18667). National Bureau of Economic Research.

Case, K. E., Quigley, J. M., & Shiller, R. J. (2001). Comparing wealth effects: the stock market versus the housing market.

Catte, P., Girouard, N., Price, R. W., & André, C. (2004). Housing markets, wealth and the business cycle. OECD Economics Department Working Papers, No. 394. OECD Publishing.

Chamon, M. D., & Prasad, E. S. (2010). Why are saving rates of urban households in China rising? American Economic Journal: Macroeconomics, 93–130.

Chen, H. (2006). Development of financial intermediation and economic growth: The Chinese experience. China Economic Review, 17(4), 347–362.

Chen, J., & Huang, S. (2013). Judicial Independence and Market Fragmentation-Evidence from the Geographical Rotation of Judges in China. Economic Research Journal, 9, 56–70 (in Chinese).

Chen, N. K., Chen, S. S., & Chou, Y. H. (2010). House prices, collateral constraint, and the asymmetric effect on consumption. Journal of Housing Economics, 19(1), 26–37.

Engelhardt, G. V. (1996). House prices and home owner saving behavior. Regional Science and Urban Economics, 26(3), 313–336.

Gan, J. (2010). Housing wealth and consumption growth: Evidence from a large panel of households. Review of Financial Studies, hhp127.

Gao, B., Chen, J., & Zou, L. (2012). Regional housing price differences, labor mobility, and industrial upgrading. Economic Research Journal, 1, 66–78 (in Chinese).

Giuliano, P., & Ruiz-Arranz, M. (2009). Remittances, financial development, and growth. Journal of Development Economics, 90(1), 144–152.

Giuliodori, M. (2005). The role of house prices in the monetary transmission mechanism across European countries. Scottish Journal of Political Economy, 52(4), 519–543.

Goldsmith, R. W. (1969). Financial structure and development (No. HG174 G57).

Green, R. K., & Malpezzi, S. (2003). A primer on US housing markets and housing policy. The Urban Institute.

Hansen, B. E. (1999). Threshold effects in non-dynamic panels: Estimation, testing, and inference. Journal of Econometrics, 93(2), 345–368.

Hassan, M. K., Sanchez, B., & Yu, J. S. (2011). Financial development and economic growth: New evidence from panel data. The Quarterly Review of Economics and Finance, 51(1), 88–104.

Hui, E. C. M., Ng, I., & Lau, O. M. F. (2011). Speculative bubbles in mass and luxury properties: An investigation of the Hong Kong residential market. Construction Management and Economics, 29(8), 781–793.

Hui, E. C., & Wang, Z. (2014). Price anomalies and effectiveness of macro control policies: Evidence from Chinese housing markets. Land Use Policy, 39, 96–109.

Hui, E. C., Zheng, X., & Zuo, W. J. (2012). Housing wealth, stock wealth and consumption expenditure: A dynamic analysis for Hong Kong. Property Management, 30(5), 435–448.

Khalifa, S., Seck, O., & Tobing, E. (2013). Housing wealth effect: Evidence from threshold estimation. Journal of Housing Economics, 22(1), 25–35.

Kuang, W. (2011). Housing price and urban household consumption in China. World Economy, 10, 21–34 (in Chinese).

Levine, R. (1999). Bank-based and market-based financial systems: Cross-country comparisons. Vol. 2143.World Bank Publications.

Levine, R. (2005). Finance and growth: Theory and evidence. Handbook of Economic Growth, 1. (pp. 865–934).

Li, C., Li, J., & Chen, X. (2013). The research on influences of house price fluctuation on the urban residents consumption in China. Statistical Research, 2, 004 (in Chinese).

Li, C., Li, J., & Chen, X. (2014). The crowding out effect of housing price rise on residents' consumption in China. Statistical Research, 12, 32–40 (in Chinese).

Li, T., & Chen, B. (2014). Real assets, wealth effect and household consumption: Analysis based on China household survey data. Economic Research Journal, 3, 63–75 (in Chinese).

Liang, Y., & Gao, T. (2007). Empirical analysis on real estate price fluctuation in different provinces of China. Economic Research Journal, 8, 133–142 (in Chinese).

Ljungwall, C., & Li, J. (2007). Financial sector development, FDI and economic growth in China. China Center for Economic Research.

Ludwig, A., & Sløk, T. (2002). The impact of changes in stock prices and house prices on consumption in OECD countries, 1.International Monetary Fund.

Moser, C. O., Gatehouse, M., & Garcia, H. (1996). Urban poverty research sourcebook: Module II, indicators of urban poverty. UNDP/UNCHS/World Bank-UMP.

Peltonen, T. A., Sousa, R. M., & Vansteenkiste, I. S. (2012). Wealth effects in emerging market economies. International Review of Economics & Finance, 24, 155–166.

Rajan, R. G., & Zingales, L. (2003). The great reversals: The politics of financial development in the twentieth century. Journal of Financial Economics, 69(1), 5–50.

Renaud, B. (1989). Affordable housing and housing sector performance: The housing priceto-income ratio as summary indicator. Centre of Urban Studies and Urban Planning: University of Hong Kong.

Sheiner, L. (1995). Housing prices and the savings of renters. Journal of Urban Economics, 38(1), 94–125.

Sierminska, E., & Takhtamanova, Y. (2012). Financial and housing wealth and consumption spending: Cross-country and age group comparisons. Housing Studies, 27(5), 685–719.

Wei, S. J., & Zhang, X. (2009). The competitive saving motive: Evidence from rising sex ratios and savings rates in China (No. w15093). National Bureau of Economic: Research.

World Bank (2012). Global financial development report 2013: Rethinking the role of the state in finance. Washington, DC: World Bank.

Zang, B., Lv, P., & Warren, C. M. (2015). Housing prices, rural–urban migrants' settlement decisions and their regional differences in China. Habitat International, 50, 149–159.

Zhang, H., Li, L., Chen, T., & Li, V. (2016). Where will China's real estate market go under the economy's new normal? Cities, 55, 42–48.