An Empirical Study of Housing Wealth and Consumption in China

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Abstract

Using the most recent data from 2006 to 2018, I examine the relationship between housing wealth and residents' consumption with macro models and micro models. Splitting the sample into two periods, the macro data analysis suggests that the housing wealth effect is significantly positive in the period from 2006 to 2012 while it is not significant from 2013 to 2018. The micro evidence shows that the housing wealth effect on household consumption is generally positive, differing from regions, years, gender, education and other factors. The micro analysis results can explain part of the reason why housing wealth effect is weakening in China, but more evidence is needed to get a better understanding of this issue.

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1.Introduction

For a long time, investment and exports have been the main drivers of China's economic growth, and the contribution rate of consumption was relatively low. Today, China is facing a new economic environment, both at home and abroad. Domestically, after 30 years of extensive economic development characterized by high input, inefficiency, industry overcapacity, serious waste of resources and heavy environmental pollution, the cost of production factors continues to rise, leading to a limited effect of investment on the role of economic growth in the future. Abroad, trade protection is becoming quite prevalent. The emergence of trade barriers increases the uncertainty of China's exports. In the future, China's exports are likely to encounter more and more trade barriers, which can be a problem due to its export size and trade surpluses. The dual challenges of internal and external aspects make China's traditional economic growth model unsustainable. Therefore, expanding consumption seems to be the best option to achieve sustainable economic growth.

Table1.1: The structure and trend of household assets (2013, 2015, 2017)

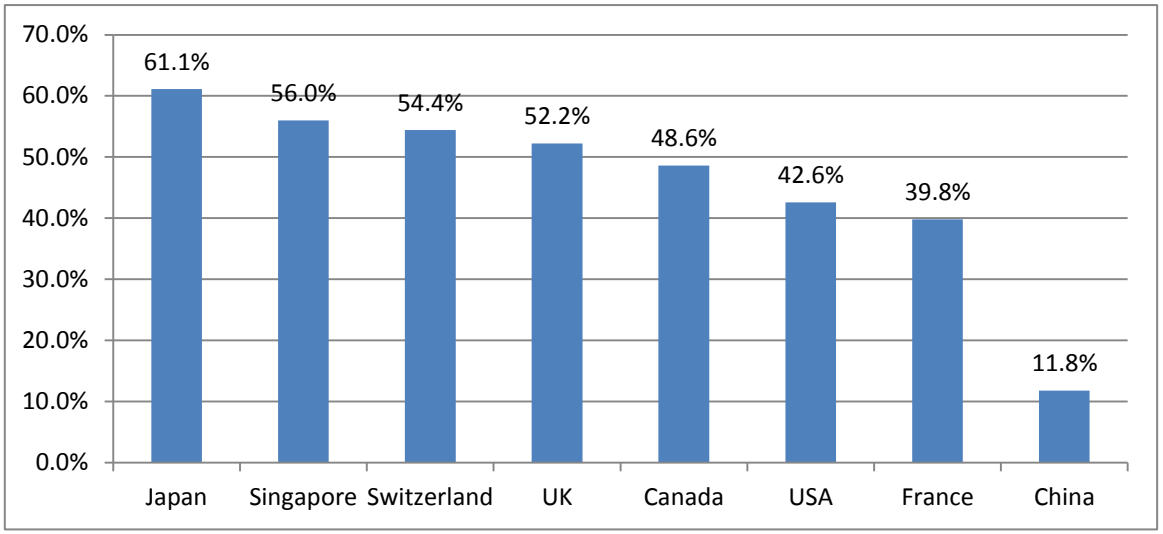
	Proportion of total assets		
Year	2013	2015	2017
Housing assets	68.3	70.1	77.7
Financial assets	10.3	14.6	11.8
Industrial and commercial assets	9.9	6.9	5.6
Other assets	11.5	8.3	4.9

Note: data from CHFS（China Household Finance Survey）

In recent years, the sustained and rapid growth of house prices in China has made real estate

account for a high proportion of total household assets. CHFS (China Household Finance Survey) data show that in 2013-2017, housing assets accounted for a rising share of total assets, reaching 77.7% in 2017; financial assets accounted for less than 15%; and the share of industrial and commercial assets and other types of assets showed a downward trend. This shows that in China, housing assets accounts for the highest proportion of total household assets while the proportion of financial assets is low, and the gap is increasing, which indicates that housing assets are the main component of China's household wealth.

Figure1.1: Household financial assets allocation ratio in different countries



Data source: China urban household wealth health report

Compared with developed countries such as the United States, China's household financial assets allocation ratio is very low, and the proportion of housing assets is very high. In 2017, the proportion of housing assets in China's total household assets was 77.7%, much higher than 34.6% in the United States; while the share of financial assets in China was only 11.8%, compared with 42.6% in the United States. Meanwhile, Japan's financial assets accounted for 61.1% of total assets; Singapore, Switzerland and the United Kingdom accounted for a

relatively low share of financial asset allocation, but were also more than half; Canada was 48.6%; and France was lower, at 39.8%, but all of them were well above 11.8% in China. A higher proportion of housing assets absorbs too much household liquidity and squeezes the allocation of financial assets to households.

The termination of the distribution system of housing in China in 1998 opened the era of housing commercialization. Then China's real estate marketization reform launched in a comprehensive manner. After a rapid development of the real estate industry in two decades, it has gradually become one of the pillar industries of the national economy. Along with the prosperity of the real estate market, house prices rose rapidly from 2053 Yuan in 1999 to 7827 yuan in 2017. The rise in house prices over the past more than 20 years is a double-edged sword. On the one hand, it brought wealth appreciation to house owners; on the other hand, it also consumed a big part of residents ' savings and dragged the economy.

The real estate industry has a close relationship with the national economy and the stability of the real estate market is very important for the stable development of the economy. The 2008 subprime crisis in the United States is a famous example where the whole story started from the real estate market, and then the financial crisis caused by the real estate industry fluctuations swept the world, resulting in financial shocks in many countries. Now in China, the study of real estate wealth effect has some new meanings. On the one hand, the consumption rate of residents is still low; on the other hand, China is changing into a new

development pattern of the economy with consumption structure upgrading. Studying the effect of real estate wealth in the current period is of great significance for boosting consumption and stabilizing the economy in China.

The impact of real estate price fluctuation on consumption, that is, the real estate wealth effect, has been found to be significant in many countries around the world. So, what about the situation in China? Dose the rise of house price crowd out consumption or boost consumption? And how should we measure the extent of the impact? The contributions of this article can be concluded as the following:(1) using the latest macro data and micro data to examine the housing wealth effect in China, I get the result that the housing wealth effect is weakening in China; (2)I analysis the reason behind this phenomenon and get some possible explanations.

2. Literature Review

The early empirical studies of housing wealth effect mainly focus on four aspects: first, test of the existence of housing wealth effect and the measurement of the effect strength; second, the comparison of the wealth effect between real estate and other assets, mainly financial assets; third, the differences of housing wealth effect of different countries; and other further studies.

Early studies of the test and measurement of housing wealth effect is based on the overall market and the entire population, but the conclusions are very controversial. An early study

made by Elliot (1980), which was based on a permanent income model of consumer expenditures, chose consumers' measurable income and asset stocks as explanatory variables and found that cash and financial assets could affect consumer spending, while savings and real assets have no impact on consumption. Using the behavioral life-cycle savings model, Levin (1998) found that consumption spending is not very sensitive to changes in the value of houses, which means the housing wealth effect does not exist.

However, some other scholars hold an opposite view. Peek (1983) questioned previous research data, arguing that real estate accounts for a large proportion of total household assets, so that the wealth effect of net capital gains should not be overlooked. The results of his study showed that there was a significant housing wealth effect. Cheney (2006) made an empirical study based on Sweden's quarterly data from 1980 to 2004, confirming that rising house prices can increase consumer spending, with a long-term housing wealth effect of 0.11.

Some scholars have further suggested that since real estate can be both necessity goods and investment goods in the meantime, rising house prices will have both positive and negative effects on consumption (Cheng, 2008). Some scholars carried out researches to study the relationship between financial environment and housing wealth effect, generally finding that the more mature the financial industry is, the more significant the housing wealth effect would be. Muellbauer (2007) found that the wealth effect of the housing market was more pronounced in OECD countries with looser credit conditions. Cheng (2008) did an empirical

test of VAR model and found that the wealth effect of housing market will increase with the increase of market leverage.

For the part of the comparison of the wealth effect between real estate and others, factors including the liquidity of assets, the expected rate of return, the financial policies, asset structure, consumers' consumption habits, and preferences are believed to have impacts on the wealth effect of assets.

Some scholars believe that the wealth effect of real estate is small. For example, Dvornak and Kohler (2003) found that there was both significant equity wealth effect and housing wealth effect in Australia, but the wealth effect of equities was stronger in the long run, where the consumption growth generated by 1 dollar in stock wealth increased by 3 to 6 cents more than that of real estate.

However, more studies have found that the housing wealth effect is more pronounced. Some scholars use the time series data of one country to make empirical analysis and find that under the same conditions, the housing wealth effect is much greater than the wealth effect of financial assets. For example, Carroll (2018) used quarterly data of the United States to establish a cointegration model and found that the wealth effect of real estate is about 0.09, and the wealth effect of financial assets is only about 0.04.

There are also many scholars who use data from multiple countries to build panel models, and the conclusions also support this view. For example, Bayoumi and Edison (2003) used data from 16 countries in 30 years and Case (2005) built a panel of 14 countries observed annually during 25 years to test the relationship between housing wealth, financial wealth, and consumer spending. The results show that countries generally have significant and positive housing wealth effect, which is larger than the stock market wealth effect.

Because of many factors that influence asset wealth effect, the comparison of housing wealth effect in different countries has also aroused lots of attention. Alexander (2002) makes an empirical analysis using 1985-2000 panel data from 16 OECD countries and find that the housing wealth effect is 0.035, where the number of market-led countries is 0.031 and that of the bank-led countries is 0.107. Similarly, Catte (2004) uses OECD countries' panel data as sample and find that the housing wealth effect varies greatly from country to country: France and Germany are not significant; Italy, Japan, Spain, the United Kingdom, the US and other five countries are between 0.01 and 0.02; Australia, Canada, The Netherlands and other three countries are between 0.05 and 0.08. Sierminska (2007) uses micro data for empirical testing and the results show that the elasticity of house prices to consumption in Canada is about 0.12, 0.10 in France, and 0.13 in Finland. Ludwig and Sløk (2002), using data from 16 developed countries for 1970-2000, conclude that changes in wealth in market-based economies have resulted in greater wealth effects than bank-based economies; the wealth effect of rising house

prices is greater than the wealth effect of rising stock prices; over time, the wealth effects of rising stocks and housing prices are increasing in all economies.

At present, more measurement methods have been introduced into the housing wealth effect research and the research direction is more detailed. Diaz and Luengo-prado (2010) use a general equilibrium model of heterogeneous agents with idiosyncratic uncertainty and introduce the factors such as housing liquidity and collateral credit to assess the impact of the liquidity of housing assets on wealth inequality. Kiyotaki (2011) develops a life-cycle model of a production economy to make a quantitative theoretical research on the interaction between house prices, aggregate production and household behavior in the life cycle of residents. In particular, it is worth mentioning Carrol (2011), who focuses on household consumption and savings decisions, introduces a new method based on the consumption habit factor or the stickiness of consumption for measuring wealth effects to distinguish between immediate and eventual wealth effects.

After the housing reform and the first round of rapid rise in house prices, Chinese scholars began to pay attention to the study of housing wealth effect. Due to the lack of data, the early research is mainly theoretical and qualitative, such as Tang Jianwei (2004) and Liu Jianjiang (2005), which are a comparative study of housing and stock wealth effects and a theoretical research on the transmission mechanism of housing wealth effects. At present, researches in China mainly focus on the following two aspects:

First, for the existence of housing wealth effect in China, there is a lot of controversy about whether there is a housing wealth effect. Some studies believe that rising house prices in China will inhibit consumption and the wealth effect is weak or negative. For example, Liu (2007) argues that the housing market supply structure is unreasonable and a large number of housing demand has not been met, so the rise in house prices will only lead to the result that residents spend more money to buy a house, instead of an increase in consumption; Luo Zuoyan (2007) believes that the strong precautionary saving motivation and liquidity constraints of Chinese residents have a strong limit on the effect of housing wealth. Some scholars use provincial panel data further verified that the housing wealth effect is negative (Jin Tao, Jiang Kai, 2012). On the other hand, the opposite view is that China's housing wealth effect is remarkable. For example, Wei (2007) believes that China's long-term and short-term housing wealth effect is significantly positive; Li and Shen (2007) make an empirical study on the relationship of housing prices and consumption out of the data from four major cities in China, and the conclusion is significantly positive.

The comparative study of the effects of stock and housing wealth in China began with the simultaneous growth in share prices and house prices in 2007. Since then, quite a number of studies have been made in this area while there is still no widely accepted conclusion. Some scholars believe that China's stock market is not stable, so the housing wealth effect is more significant than the wealth effect of stocks (Zhao Xiaoli 2007). Some scholars believe that the

excessive rise in house prices and liquidity constraints will inhibit the consumption demand of residents, so the housing wealth effect is slightly weaker than wealth effect of stock (Luo, 2007). Ding Pan and Hu Zongyi (2008) believe that neither is significant, but the impact of house price fluctuations on consumption is slightly greater.

The change of house price could affect household spending decisions by changing the savings plan for potential buyers, or by changing a household's future income as well as spending expectations. Many researchers have described how house price changes affect consumption in terms of liquidity and credit constraints. In addition to affecting residents' budgetary constraints and borrowing constraints, changes in asset prices also affect consumption through factors such as future expectations and the degree of development of financial markets.

The six different mechanisms of housing wealth effect proposed by Ludwig and Slok (2002) are considered to be the most comprehensive:

1. Realized wealth effect, which means that the revenue got from the rental and sale of houses increases by the rise in house prices, thus increasing consumption.

2. Unrealized wealth effect. Even if it does not realize, rising house prices make residents who own houses feel richer, thus increasing consumption.

3. Liquidity constraints effect, which is mainly about housing mortgage income.

4. Budget constraint effect. For renters, rising house prices are likely to trigger the rise of

rents. As a result, they may reduce spending in other areas.

5. Substitution effect. For planned buyers, rising house price require more investment in buying a house, and in the meantime they may reduce consumption.

6. Confidence effect, which is mainly reflected in the confidence of residents towards the macro economy and the housing market. Some homeowners believe that their real estate investment income is lasting and stable, consumption increased accordingly.

Liu Yufei (2018) proposed a two-stage transmission mechanism of housing wealth effect in China, with 8 mechanisms in total. After the rise of house prices:

1. Residents who own housing will increase consumption due to the direct wealth effect.

2. Residents who own housing have an optimistic expectation of asset appreciation and the macroeconomic situation, which will lead to an increase in consumer consumption. On the other hand, the optimistic expectation of the economy may also make the residents without houses spend more on consumption.

3. The value added of housing can alleviate the liquidity constraints of homeowners and increase consumption; while for renters, the liquidity constraint effect is enhanced and consumption is reduced.

4. Higher house prices lead to higher rents, which will reduce consumption of renters.

5. As a result of the custom formation effect, residents in China rarely mortgage their homes to increase consumption, so rising house prices will not only not ease the liquidity constraints

of residents.

6. As a result of the intergenerational effect of consumption, rising house prices have deterred older residents from enjoying the benefits of asset appreciation. Instead they have to consider buying houses for their children, then the incentive for preventive savings increase.

7. The rise in house prices is often accompanied by the government's housing price overheating regulation policy. Due to the impact of policy information impact, the consumption of residents may be affected but the degree of impact is highly uncertain.

8. The government’s policy on house prices makes it impossible for residents to make a clear judgment on the future trend of house prices. Thus the uncertainty is increased and the motivation of preventive savings is increased, and consumption may decrease.

In housing markets with different sizes, different degrees of development, different degrees of real estate liquidity and different financial market development degrees, these effects play in a different way, so the overall wealth effect of the rise in housing prices is not clear. The time of China's housing market development is still short with features like a gradually deepening understanding of residential wealth and large regional difference. Consequently, the housing wealth effect still needs more empirical test, especially for developing markets like China.

In order to capture the essentials of theories and examine the relationship between consumption and housing wealth in more recent times, from 2006-2018, the following hypotheses should be made:

Hypothesis 1: There is no significant housing wealth effect in China, which means that there is no relationship between consumption and housing wealth.

Hypothesis 2: The change of housing wealth has significant impact on consumption and an appreciation of housing assets will increase residents' consumption.

Hypothesis 3: The change of housing wealth has significant impact on consumption and an appreciation of housing assets will reduce residents' consumption.

3. Methods

3.1 The macro model

The Life Cycle Hypothesis (LCH) of consumption and savings was set up by Franco Modigliani, R. Brumberg and Alberto Ando (1954, 1963). According to LCH, it is believed that rational consumers arrange their consumption and savings based on their lifetime income to make income and consumption equal in lifetime. The family income includes labor income and property income, so the consumption function for a household is:

$$\ln C = a \cdot \ln WR + c \cdot \ln YL \quad (1)$$

$0<a<1, 0<c<1$

where C is consumption, WR is property income, YL is labor income, "a" is the marginal propensity to consume (MPC) of property income, "c" is the MPC of labor income. Based on the LCH above, Modigliani established the following aggregate consumption function:

$$\ln C_t = b_1 \ln Y_t + b_2 \ln Y^* + b_3 \ln A_t \quad (2)$$

In equation (2), C_t, Y_t, Y^*, A_t represent current consumption, current income, future income and current property respectively; b_1, b_2, b_3 represent the MPC of current income, future income and current property, respectively. Modigliani believed that future income could be counted as a multiple of current income, that is,

$$\ln Y^* = \beta \ln Y_t \tag{3}$$

The aggregate consumption function can be changed to

$$\ln C_t = (b_1 + b_2\beta)\ln Y_t + b_3 \ln A_t \tag{4}$$

So at time t, consumption $\ln C_t$ is a function of income $\ln Y_t$ and assets $\ln A_t$. LCH holds that consumers will choose the current consumption level rationally based on their lifetime wealth, to optimize and smooth their consumption of a lifetime. Real estate, as a form of wealth, has naturally become an important factor affecting the consumption level of residents along with cash, bank deposits, securities and other assets, as well as expected future income. Considering the evidence found by CHFS (as mentioned in table 1.1) that the housing wealth accounts for nearly 80% of households' wealth in China, and that the proportion is in an ascending trend, it is probably safe to substitute assets $\ln A_t$ to housing assets $\ln H_t$, so the estimating function form can be expressed in logarithmic form as:

$$\ln C_t = (b_1 + b_2\beta) \ln Y_t + b_3 \ln H_t + \sum_{i=1}^{n} b_{i+3} \ln X_{i,t} + \omega_t \tag{5}$$

where C_t is the aggregate amount of household consumption at time t, H_t is the aggregate value of real estate assets in RMB, $X_{i,t}$ represents different factors that affect household's consumption, including savings, debts, years of education and so on. Since the value of real

estate assets H_t equals to the average real estate price HP_t multiplied by the real estate stock area HS_t, that is:

$$H_t = HP_t * HS_t \tag{6}$$

So：

$$\ln C_t = (b_1 + b_2\beta)\ln Y_t + b_3 \ln HP_t + b_3 \ln HS_t + \sum_{i=1}^{n} b_{i+3} \ln X_{i,t} + \omega_t \tag{7}$$

Lag 1:

$$\ln C_{t-1} = (b_1 + b_2\beta)\ln Y_{t-1} + b_3 \ln HP_{t-1} + b_3 \ln HS_{t-1} + \sum_{i=1}^{n} b_{i+3} \ln X_{i,t-1} + \omega_{t-1} \tag{8}$$

Then equation (7) minus (8), we can get：

$$c_t = (b_1 + b_2\beta)y_t + b_3 hp_t + b_3 hs_t + \sum_{i=1}^{n} \alpha_i x_{i,t} + \omega_t - \omega_{t-1} \tag{9}$$

where,

$$c_t = \ln C_t - \ln C_{t-1} \approx (C_t - C_{t-1})/C_t \tag{10}$$

where c_t represents the rate of change of aggregate consumption, similar for other variables. According to 2018 China Statistical Yearbook, the aggregate stock housing area is 42.02 billion square meters in China, and the quarterly housing sales area are about 0.3 billion square meters in 2018, so the growth rate is around 0.7% per quarter, which is a relatively small number compared with 2.2% of quarterly house price growth rate and 8% to 10% annually income growth rate. Considering that the rate of change of other variables is relatively small comparing to that of house prices and income, so assume that:

$$hs_t \approx 0$$

$$x_{i,t} \approx 0$$

Therefore, the approximate estimation form of equation (9) is

$$c_t = (b_1 + b_2\beta)y_t + b_3 hp_t + \varepsilon_t$$

Then do some substitution to make the coefficients more concise,

$$c_t = \alpha_0 hp_t + \alpha_1 y_t + \varepsilon_t \tag{11}$$

where y_t is the rate of change of income, $\varepsilon_t = \omega_t - \omega_{t-1}$. By estimating α_0, we can draw the short-term elasticity of consumption spending to changes in house price, and thus estimate the short-term housing wealth effect.

To make a regression of time series variables, first we need to examine the stationarity properties of the time series. When a variable has unit root, it is considered to be non-stationary, which could lead to spurious results in time-series regression. Phillips and Perron's test and Augmented Dickey-Fuller test are usually used in unit root test. If the time series are stationary, then we can consider further tests like heteroskedasticity and autocorrelation test and start to establish suitable regression model; if the time series are non-stationary, we can consider cointegration regression. Cointegration analysis makes it possible to identify long-run economic relationships between two or more non-stationary variables and to avoid the risk of spurious regression. Set $\mathrm{y}_t = (\mathrm{y}_{1t}, \mathrm{y}_{2t}, \ldots, \mathrm{y}_{kt})'$ as k-dimensional random time series, t=1, 2, …,T, y_t~I(1), so consider the VAR(p) model as:

$$\mathrm{y}_t = A_1 \mathrm{y}_{t-1} + A_2 \mathrm{y}_{t-2} + \cdots + A_p \mathrm{y}_{t-p} + \mu_t \tag{12}$$

Within the Johansen multivariate cointegration framework, the following Vector Error

Correcting Mechanism (VECM) system is estimated after cointegration transformation:

$$\Delta y_t = \Gamma y_{t-1} + \sum_{j=1}^{p-1} \theta_j \Delta y_{t-j} + \mu_t \quad (13)$$

where, $\Gamma = \sum_{j=1}^{p} A_j - I$, $\theta_j = -\sum_{j=1}^{p} A_j$. Set $\Gamma = \alpha\beta'$, where Γ are (k×k) and α, β are (r×r), rank(Γ)= rankα)= rank(β)=r, and $\beta' y_{t-1} \sim I(0)$. Make a substitution in equation (13) and get:

$$\Delta y_t = \alpha\beta' y_{t-1} + \sum_{j=1}^{p-1} \theta_j \Delta y_{t-j} + \mu_t \quad (14)$$

where $\beta' y_{t-1}$ is the Error Correcting Term, which reflects the long run relationship between variables; β contains the r cointegration relationships; α carries the corresponding adjustment coefficients in each of the r vectors.

Another method on constructing VECM is Engle-Granger two-step method: first, carry out cointegration regression using MLE or FMOLS method, test the cointegration relationship between variables, and estimate the cointegration vector (long-term equilibrium relation parameters); then, if the cointegration exists, add the residual difference obtained by the first step to the error correction model and estimate parameters with OLS method. In this way, we can obtain the long-term elasticity of consumption spending to changes in house price to estimate the long-term housing wealth effect.

3.2 The micro model

According to equation (5), we can get the direct estimation model as

$$\ln C_i = \alpha_0 + \alpha_1 \ln H_i + \alpha_2 \ln Y_i + \sum_{k=1}^{m} \alpha_{k,i} X_{k,i} + \varepsilon_i \quad (15)$$

$\ln C_i$, $\ln H_i$ and $\ln Y_i$ represent the logarithm of consumption, house value and income of

household “i” at the time when the survey is conducted. X represents control variables including age, gender, level of education, family population, source of housing, survey year, regional factors and so on. By estimating α_1, we can get the elasticity of consumption to house value as an estimate of micro housing wealth effect. In order to further test the housing wealth effect with differences in genders, ages, years and regions, I construct the combined term of virtual variables and house value to estimate time characteristics, regional characteristics and demographic characteristics of the housing wealth effect.

$$\ln C_i = \alpha_0 + \alpha_1 \ln H_i + \alpha_2 \ln Y_i + \sum_{k=1}^{m} \alpha_{k,i} X_{k,i} + \sum_{j=1}^{l} \alpha_{j,i} X_{j,i} \ln H_i + \varepsilon_i \qquad (16)$$

where $j \neq k$.

4. Macro evidence of housing wealth effect

4.1 Sample data

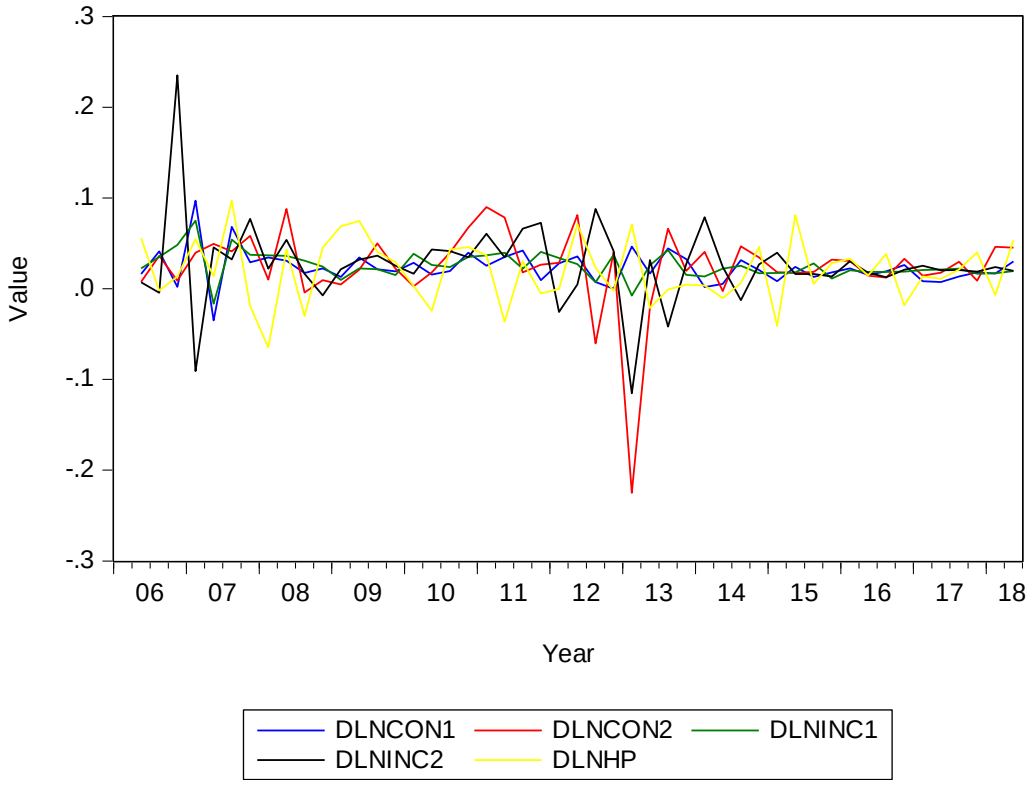
All data of macro part is from the National Bureau of Statistics of China <http://data.stats.gov.cn/> on a quarterly frequency, from 2006q1 to 2018q2, 50 periods in total. The consumption and income of residents were measured by the per capita consumption expenditure of urban residents and the per capita disposable income of urban residents. The price level of commercial housing is defined as the result of aggregate quarterly sales of commercial housing divided by the quarterly sales area. The consumption expenditure per capita is the independent variable; the disposable income per capita and the price level of commercial housing are used as dependent variables. Logarithmic processing is used to the

original data to avoid the heteroscedasticity of the time series. Furthermore, the X12 seasonal adjustment method in Eviews is used to get rid of the instability caused by the seasonal variation of the time series.

Table 4.1.1: Descriptive statistics of variables in log-differences (2006Q1 to 2018Q2)

	DLNCON1	DLNCON2	DLNINC1	DLNINC2	DLNHP
Mean	0.0232	0.0239	0.0253	0.0264	0.0199
Median	0.0206	0.0265	0.0223	0.0242	0.0144
Maximum	0.0971	0.0900	0.0749	0.2353	0.0970
Minimum	-0.0350	-0.2249	-0.0166	-0.1151	-0.0645
Std. Dev.	0.0190	0.0455	0.0146	0.0471	0.0346
Observations	49	49	49	49	49

Figure 4.1.1: Line chart of variables in log-differences (2006Q1 to 2018Q2)



4.2 General tests and estimation

In this section, the housing wealth effect will be tested with macro evidence of China, from 2006Q1 to 2018Q2. In the following models, consumption is set as the dependent variable, income and house price are set as independent variables. The purpose of this section is to find how the change of house price affects consumption in China.

4.2.1 Unit root tests

If the time series has a unit root, it will cause a problem of spurious regression for variables. Through cointegration analysis, we can investigate the long-term equilibrium relationship between economic variables, and one of the requirements of cointegration analysis is that the

sequence is in the same order process, so it is needed to test the stationary of the original data and the first-order difference sequence data to verify the applicability of the cointegration analysis. Only when the sequence is in the same order process cointegration can be used.

Table 4.2.1: Unit root tests (ADF test) (2006Q1 to 2018Q2)

	Original				
	1% level	5% level	10% level	ADF test statistic	Prob.
Consumption of Urban Residents (lncon1)	-3.5713	-2.9224	-2.5992	-1.7889	0.3816
Income of Urban Residents (lninc1)	-3.5713	-2.9224	-2.5992	-2.9657	0.0543
Consumption of Rural Residents (lncon2)	-3.5713	-2.9224	-2.5992	-1.0506	0.7277
Income of Rural Residents (lninc2)	-3.5713	-2.9224	-2.5992	-1.4877	0.5314
House Price (lnhp)	-3.5713	-2.9224	-2.5992	-0.9864	0.7511
	After first order difference				
	1% level	5% level	10% level	ADF test statistic	Prob.
Consumption of Urban Residents (lncon1)	-3.5744	-2.9238	-2.5999	-11.8534	0.0000
Income of Urban Residents (lninc1)	-3.5744	-2.9238	-2.5999	-7.6141	0.0000
Consumption of Rural Residents (lncon2)	-3.5744	-2.9238	-2.5999	-6.5585	0.0000
Income of Rural Residents (lninc2)	-3.5744	-2.9238	-2.5999	-9.4513	0.0000
House Price (lnhp)	-3.5744	-2.9238	-2.5999	-8.3494	0.0000

The lag selection of the ADF test is based on Schwartz Information Criterion. The ADF tests are performed on the basis of 5 percent significance level with the null hypothesis that is of no stationarity. As can be seen in the tables above, all variables are not stationary at conventional levels at 5% significance level while the null hypothesis is rejected at first differences. So, it

is concluded that results indicate that all variables are integrated of order one i.e. $I_{(1)}$, which allows us to proceed with the cointegration test. Therefore, we can use the method of Johansen cointegration test to analyze the housing wealth effect of urban and rural residents.

4.2.2 Cointegration tests

Table 4.2.2: Unrestricted Cointegration Rank Test (Trace) of Model(1) (2006Q1 to 2018Q2)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None *	0.4091	47.9971	29.7971	0.0002
At most 1 *	0.2374	23.2677	15.4947	0.0028
At most 2 *	0.2007	10.5302	3.8415	0.0012

Trace test indicates 3 cointegrating equations at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

Table 4.2.3: Unrestricted Cointegration Rank Test (Trace) of Model (2) (2006Q1 to 2018Q2)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.
None *	0.4091	47.9971	29.7971	0.0002
At most 1 *	0.2374	23.2677	15.4947	0.0028
At most 2 *	0.2007	10.5302	3.8415	0.0012

Trace test indicates 3 cointegrating equations at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

The test results are listed in table 4.2.2 and table 4.2.3, noted as model (1), which represents the urban model, and model (2), which is the rural model. Trace test indicates that there are more than 2 cointegration equations at the 0.01 level of significance for model (1) and model (2).

4.2.3 Collinearity autocorrelation and heteroskedasticity

We can see that the correlation coefficients among variables are low, as shown in table 4.2.4 and table 4.2.5, so we can exclude multicollinearity among the explanatory variables.

Through OLS we can get DW statistics of each equation. The results of DW test are all $d_u < DW < 4 - d_u$, so there is no autocorrelation. However, White test results (shown in table 4.2.6) show that there is heteroskedasticity in OLS models, so Weighted Least Squares (WLS) are used instead of OLS in order to reduce the effects of heteroscedasticity. Minimize $\sum_{i=1}^{n} w_i(y_i - \alpha_0 - \alpha_1 x_{i1} - \cdots - \alpha_p x_{ip})^2$, where $w_i = \frac{1}{\sigma_i^2}$, then get the estimation of α. The estimation results are listed in table 4.2.8.

To get the estimates of cointegrating equations, Fully Modified Least Squares (FMOLS) regression is introduced here and results are listed in table 4.2.7. FMOLS was originally designed in work by Phillips and Hansen (1990) to provide optimal estimates of cointegrating regressions. This method modifies OLS to account for serial correlation effects and for the endogeneity in the regressors that result from the existence of a cointegrating relationship. Plus, compared with Maximum Likelihood Estimate, FMOLS is better in dealing with small sample cointegrating regressions.

Table 4.2.4: The correlation among variables of model (1) (2006Q1 to 2018Q2)

	LNCON1	**LNINC1**	**LNHP**
LNCON1	1.0000	0.4393	0.1956
LNINC1	0.4393	1.0000	-0.1999
LNHP	0.1956	-0.1999	1.0000
	DLNCON1	**DLNINC1**	**DLNHP**
DLNCON1	1.0000	0.6020	0.3063
DLNINC1	0.6020	1.0000	-0.0951
DLNHP	0.3063	-0.0951	1.0000

Table 4.2.5: The correlation among variables of model (2) (2006Q1 to 2018Q2)

	LNCON2	LNINC2	LNHP
LNCON2	1.0000	0.2598	-0.0570
LNINC2	0.2598	1.0000	-0.1284
LNHP	-0.0570	-0.1284	1.0000
	DLNCON2	**DLNINC2**	**DLNHP**
DLNCON2	1.0000	0.2846	-0.0870
DLNINC2	0.2846	1.0000	-0.1900
DLNHP	-0.0870	-0.1900	1.0000

Table 4.2.6: Heteroskedasticity Test White (2006Q1 to 2018Q2)

White Test of model (1)			
F-statistic	**7.6502**	**Prob. F(5,43)**	**0**
Obs*R-squared	**23.0681**	**Prob. Chi-Square(5)**	**0.0003**
Scaled explained SS	**36.4494**	**Prob. Chi-Square(5)**	**0**
White Test of model (2)			
F-statistic	**13.3299**	**Prob. F(5,43)**	**0**
Obs*R-squared	**29.7842**	**Prob. Chi-Square(5)**	**0**
Scaled explained SS	**149.6246**	**Prob. Chi-Square(5)**	**0**

4.2.4 Estimation results and analysis

Table 4.2.7: Estimates of cointegration equations (2006Q1 to 2018Q2)

(long run housing wealth effect)

	Model(1)	Model(2)
Constant	0.1295	0.9672*
	(1.2266)	(1.8691)
lnhp	0.0633	-0.0271
	(1.4481)	(-0.1742)
lninc1	0.8803***	
	(26.8344)	
lninc2		0.8850***
		(7.8191)
R^2	0.9986	0.9733

Method: Fully Modified Least Squares (FMOLS)

Note: *,**,*** denote significance at the 10,5,1 percent level respectively. T-statistics is in parentheses.

Long run cointegration equations:

Model (1):

$$\ln C_t = 0.1295 + 0.0633 \ln HP_t + 0.8803 \ln Y_t$$

t:	1.2266	1.4481	26.8344
p-value:	0.2261	0.1542	0.0000

Model (2):

$$\ln C_t = 0.9672 - 0.0271 \ln HP_t + 0.8850 \ln Y_t$$

t:	1.8691	-0.1742	7.8191
p-value:	0.0678	0.8625	0.0000

Table 4.2.8: Estimates of short run VECM equations (2006Q1 to 2018Q2)

(short run housing wealth effect)

	Model(1)	**Model(2)**
Constant	-0.0088***	0.0276***
	(-2.9851)	(5.4414)
dlnhp	0.1467***	0.1005
	(3.6257)	(0.8973)
dlninc1	1.1690***	
	(12.2193)	
dlninc2		0.2681*
		(1.9327)
$\mathbf{R^2}$	0.3006	0.0162
$\mathbf{R_w^2}$	0.8084	0.0318
$\mathbf{R_n^2}$**-statistic**	155. 4348	1. 1205

Method: WLS

Note: *,**,*** denote significance at the 10,5,1 percent level respectively. Z-statistics is in parentheses.

Short run VECM equations:

Model (1):

$$\text{dln}\, C_t = -0.0088 + 0.1467\, \text{dln}\, HP_t + 1.1690\, \text{dln}\, Y_t$$

z:	-2.9851	3.6257	12.2193
p-value:	0.0028	0.0003	0.0000

Model (2):

$$\text{dln}\, C_t = 0.0276 + 0.1005\, \text{dln}\, HP_t + 0.2681\, \text{dln}\, Y_t$$

z:	5.4414	0.8973	1.9327
p-value:	0.0000	0.3695	0.0594

The results of equations above show that, overall, there is a positive relationship between house price and consumption in the urban area in China while that relationship in the rural area is not significant. In detail, in the model (1) which represents urban area, for every 1% increase in the housing price, consumption will increase by 0.0633% (though t-statistics shows it is not very significant with a p-value of 0.1542) in the long run and consumption will increase by 0.2012% (which is a very significant number with a t-statistics of 3.4888) in the short run; while for model (2), the relationship between house price and consumption is slightly negative and not significant in both long run and short run, which means that the change of house price has little impact on rural households' consumption. This finding is consistent with direct housing wealth effect and also shows a significant difference of urban area and rural area.

In addition, the goodness of fit (R^2) of the two cointegration equations are over 0.95 and the

goodness of fit of the short run VECM equations are less than 0.5, especially for the model (2) with a number of 0.0821. This is to say, in the long run, income and house price could explain over 95% changes of consumption while in the short run, this number declines to 49.58% for urban area and 8.21% for rural area respectively. Meanwhile, the F-statistics of urban area are larger than that of rural area in both long run and short run.

The data and figures of impulse responses and variance decomposition between consumption and house price are listed in the appendix. For model (1), an unexpected positive shock to house price will lead to continuous growth of consumption in 10 quarters' period, and the accumulated change is about 0.05% for every 1% shock to house price. In contrast, the impulse response of consumption to house price in model (2) is weaker, where the 10 quarters' accumulated response is 0.035%. The difference of variance decomposition results is much bigger where in mode (1) house price could explain about 40% variance of consumption but this number of model (2) is only 0.5%. Therefore, the results of impulse responses and variance decomposition suggest that the change of house price will make more influence on consumption in urban area than that in rural area, which is also in accordance with the result of former equation estimation.

Under the hypothesis that the annual housing area increase is small compared with the stock area number, the relationship between house price and consumption could be used to imply the relationship between housing wealth and consumption. So it could be concluded as there

is a positive housing wealth effect in urban areas of China and the housing wealth effect in rural area is not significant.

Table 4.2.9: Quandt-Andrews unknown breakpoint test (2006Q1 to 2018Q2)

Statistic	Value	Prob.
Maximum LR F-statistic (2013Q1)	13.52683	0
Maximum Wald F-statistic (2013Q1)	40.58049	0

Null Hypothesis: No breakpoints within 15% trimmed data

In order to further analyze the housing wealth effect in urban areas, I observed that the growth rate of house prices had declined after 2012, while the income and consumption data of urban residents maintained relatively stable growth. The result of Quandt-Andrews unknown breakpoint test, as shown in table 4.2.9, shows that 2013q1 is a breakpoint of series .So consider taking 2013q1 as the breakpoint and dividing the total sample into two sections for analysis: from the first quarter of 2006 to the fourth quarter of 2012 as section 1 and from the first quarter of 2013 to the second quarter as section 2, 28 quarters and 22 quarters respectively.

4.3 Subsample analysis (2006Q1–2012Q4)

Take ADF test to each variable in the first section under the null hypothesis that the time series has a unit root and is non-stationary while under the alternative hypothesis this is not the case, the test results (Table 4.3.1) show that the original sequences of consumption, income and housing price level have unit roots, while the first order difference sequences remain stationary under the significance level of 1%. So we can get the conclusion that the logarithmic sequences of per capita consumption, income and housing price level after

seasonal adjustment are first-order differential stationary .

Table 4.3.1: Unit root test (ADF test) (2006Q1 to 2012Q4)

			Original		
	1% level	5% level	10% level	ADF test statistic	Prob.
Consumption	-3.6999	-2.9763	-2.6274	-0.7642	0.8132
Income	-3.6999	-2.9763	-2.6274	-0.7821	0.8082
House Price	-3.6999	-2.9763	-2.6274	-0.9406	0.7592
			After first order difference		
	1% level	5% level	10% level	ADF test statistic	Prob.
Consumption	-3.7115	-2.9810	-2.6299	-12.5121	0.0000
Income	-3.7115	-2.9810	-2.6299	-6.5597	0.0000
House Price	-3.7115	-2.9810	-2.6299	-5.2544	0.0002

In order to obtain the optimal estimation model, I made some adjustments to the original model, and got four models as shown in table 4.3.2. The original estimation model $c_t = \alpha_0 hp_t + \alpha_1 y_t + \varepsilon_t$ is model (1), and the Model (2) is obtained after adding a constant term. The results show that although the constant term is only significant at 10% level, the goodness of fit (R^2) improves from 0.61 to 0.67. The significance of elasticity of consumption spending to changes in house price improves from non-significant to significant at level of 5%, while income remains very significant. Model (2) shows that for every 1% increase in income, the consumption will increase by 1.16%, that is, MPC is 1.16, larger than 1; for every 1% increase in house price, the consumption will increase by 0.15%, that is, the real estate wealth effect is estimated to be 0.15. Compared with model (1), after adding a constant term, R^2 and the significance of dlnhp of model (2) improves. But with the result that MPC>1, it means

that the marginal saving propensity (MPS) is negative. The permanent income hypothesis holds that consumption is smooth and that the impact of temporary income changes on consumption will be distributed to the entire life cycle, which means that it has little influence on the current period. So, considering the result that MPC is 1.16 of model (2), model (1) is more compatible with the traditional economics theory.

In order to improve the overall statistical characteristics of the equation, I try to add long-term equilibrium factors and estimate the long run housing wealth effect in the meantime. Since that the consumption, housing price level and income of urban residents are all first-order differential stationary sequences, I try to establish a long-term equilibrium relationship equation:

$$W = \ln C_t - c - \beta_0 \ln HP_t - \beta_1 \ln Y_t \quad (14)$$

the result of which is shown in table 4.3.3. As shown in table 4.3.4, W is stationary, which means that there is cointegration relationship among income, consumption and housing price. Since the long-term equilibrium relationship established is established, error correction model is applicable as the estimation model.

After adding a long-term equilibrium relationship W, the model (3) and model (4) are obtained. The results show that there is a significant improvement in R^2 and DW. After adding W, the model (1) changes to the model (3), with the result that R^2 improve from 0.61 to 0.85; the model (2) changes to the model (4), with the result that R^2 improve from 0.67 to

0.87. In terms of statistical characteristics and economic meanings, the long-term equilibrium relation equation model (3) with no constant is better. According to estimation result of W, the consumption spending of residents mainly depends on their income level. In the long run, residents spend 0.81% more on consumption out of every 1% of increase in income, while that of long-term housing price level increase is smaller with a number of only 0.11%. According to the results of model (3), for every 1% increase in housing price, consumption will increase by 0.14%, and for every 1% increase in income, consumption will increase by 0.83%. Combined with long-term factors and short-term factors, the change of housing prices will cause the change of residents' consumption, and its short-term effect is slightly larger than the long-term effect.

Table 4.3.2: Estimates of short run coefficients (2006Q1 to 2012Q4)

	Model(1)	**Model(2)**	**Model(3)**	**Model(4)**
Constant		-0.0127*		-0.0091**
		(-2.0348)		(-2.2886)
dlnhp	0.1120	0.1523**	0.1357***	0.1632***
	(-1.5139)	(-2.1007)	(2.8476)	(3.5833)
dlny	0.8563***	1.1626***	0.8282***	1.0484***
	(-9.0854)	(-6.6511)	(13.6508)	(9.4201)
W			1.1692***	1.1079***
			(6.0564)	(6.1555)
R^2	0.6103	0.6677	0.8459	0.8745
DW	3.2933	3.0678	1.8690	1.8822

Note: *,**,*** denote significance at the 10,5,1 percent level respectively.

Table 4.3.3: Estimates of long run coefficients (2006Q1 to 2012Q4)

	W
Constant	0.3327***
	(2.9880)
lnHP	0.1105**
	(2.6490)
lnY	0.8080***
	(24.9696)
R^2	0.9980

Note: *,**,*** denote significance at the 10,5,1 percent level respectively.

Table 4.3.4: Unit root test of W (2006Q1 to 2012Q4)

	1% level	5% level	10% level	ADF test statistic	Prob.
W	-3.6999	-2.9763	-2.6274	-5.7736	0.0001

Results analysis

1. Short-term housing wealth effect is consistent with the findings. The empirical test results show that in the short term, for every 1% increase in housing price, consumption will increase by 0.14%, which indicates that there is a positive short-term housing wealth effect of 0.14, significant at 1% level.

2. Long-term housing wealth effect is also found to be consistent with the evidence. There is a cointegration relationship among income, consumption and housing price. In the long term, for every 1% increase in housing price, consumption will increase by 0.11%, which indicates that there is a positive short-term housing wealth effect of 0.11, significant at 5% level.

3. Short-term housing wealth effect is larger than long-term housing wealth effect with a gap

of 0.03.

4. The impact of household income on consumption is greater, both in the long and short term. The impact of house price changes on consumption is less than 0.2, much smaller than that of income changes on consumption with a number of more than 0.8. This shows that income is the determining factor of consumption level, which is consistent with the view of traditional consumption theory.

4.4 Subsample analysis (2013Q1–2018Q2)

The ADF test results (Table 4.4.1) are similar to the data of the first period. The logarithm of variables are first-order differential stationary after seasonal adjustment.

Table 4.4.1: Unit root test (ADF test) (2013Q1 to 2018Q2)

			Level		
	1% level	5% level	10% level	ADF test statistic	Prob.
Consumption	-3.7880	-3.0124	-2.6461	-1.0931	0.6985
Income	-3.8085	-3.0207	-2.6504	1.2890	0.9975
House Price	-3.8085	-3.0207	-2.6504	-1.9305	0.3126
			First difference		
	1% level	5% level	10% level	ADF test statistic	Prob.
Consumption	-3.8085	-3.0207	-2.6504	-4.2644	0.0038
Income	-3.8085	-3.0207	-2.6504	-6.4752	0.0000
House Price	-3.8085	-3.0207	-2.6504	-6.8265	0.0000

In contrast to the previous results, no matter what adjustment done to the model form, the test results (Table 4.4.2) show that the coefficient of housing price changes is very small and not

significant. Meanwhile, the overall goodness of fit is also very poor. In the long-term equilibrium relationship (Table 4.4.3), the long-term housing wealth effect is also not significant, while the impact of income on consumption is very significant with a coefficient over 0.9. The results show that during this period, whether in the long or short term, the change of income is the main factor to explain consumption change, while the impact of house price changes on consumption is minimal.

Table 4.4.2: Estimates of short run coefficients (2013Q1 to 2018Q2)

	Model(1)	**Model(2)**	**Model(3)**
Constant		0.0193	
		1.8936	
dlnhp	0.0587	-0.0054	
	0.7378	-0.0654	
dlny	0.9166***	0.1306	0.9474***
	8.4806	0.3057	9.6125
W			
R2	-0.1911	0.0068	-0.2252
DW	2.3893	1.8002	2.4633

Note: *,**,*** denote significance at the 10,5,1 percent level respectively.

Table 4.4.3: Estimates of long run coefficients (2013Q1 to 2018Q2)

	W1	W2	W3
Constant	0.0476		
	0.2698		
lnHP	0.0118	0.0232	
	0.2182	0.6971	
lnY	0.9434***	0.9372***	0.9610***
	22.6197	27.4655	4882.2680
R^2	0.9965	0.9965	0.9964
DW	1.6308	1.6122	1.6037

Note: *,**,*** denote significance at the 10,5,1 percent level respectively.

During this period, the change of income is the main factor to explain consumption change, while the impact of house price changes on consumption is minimal, indicating that the housing wealth effect is not significant. There are four possible reasons. First, because of the small amount of sample data, the results are less credible. Second, because of the impact of the price-control policy, the nominal housing price deviated from the real value, and consumers expect this policy will not last long, so they believe there is little impact on household wealth, which is also consistent with life cycle hypothesis. Third, the real estate wealth effect has a directional characteristic, that is, significant with positive changes and not significant with negative changes, indicating that consumers will increase consumption spending when house prices rise, but will not react when house prices decline. Finally, it is possible that the housing wealth effect in China has indeed decreasing in recent years.

5. Micro evidence of housing wealth effect

5.1 Sample data and tests

In order to further investigate the reasons for the weakening of the housing wealth effect in recent years and the transmission mechanism, I use latest survey data of CHNS(CHNS2009, CHNS2011 and CHNS2015) <https://www.cpc.unc.edu/projects/china/data/datasets> to examine the impact of house value on household consumption. Data descriptive statistics is listed in table 5.1.1 (see in appendix). The China Health and Nutrition Survey (CHNS) is an international collaborative project between the Carolina Population Center at the University of North Carolina at Chapel Hill and the National Institute for Nutrition and Health (NINH, former National Institute of Nutrition and Food Safety) at the Chinese Center for Disease Control and Prevention (CCDC). This survey was designed to collect the data of the health, nutrition and economic status of Chinese family to see how the social and economic transformation of Chinese society is affecting the health and nutritional status of its population.

The use of microscopic household survey data can not only avoid the shortcomings of using macro data, which is that the sample size of time series data of China is still small, reducing the credibility of the estimation results. The household survey data with large sample size and detailed index category, has obvious advantages compared to macro data, especially in revealing the mechanism of housing wealth effect. We can analyze the differences of different

regions, different income layers and different age groups in detail, so as to greatly improve the accuracy of the analysis and obtain more reliable, more detailed and more persuasive empirical results.

The correlation coefficients (see in table 5.1.2 in appendix) among the most explanatory variables are low. Therefore, it is verified that there is no collinearity among the explanatory variables. Using the White test in Stata, there is heteroskedasticity among errors at 5% level of significance. Then the robust least square regression is used.

Table 5.1.3: White's test

White's test for Ho: homoskedasticity

	chi2	p-value
Heteroskedasticity	935.66	0

5.2 Estimation of equations and analysis

The empirical model is equation (17). $\ln C_i$, $\ln H_i$, $\ln Y_i$ represents the logarithm of the consumption, house value and household income of family i, respectively. X represents control variables, including the age, gender, type of work, level of education, family size, survey time, region, etc. Among them, “hhsize” is the number of family members; “urban” represents urban-rural difference, where 1 denotes urban area and 0 denotes rural area; “gender” represents gender, where 0 denotes male and 1 denotes female; “educ” represents the highest level of education attained, where 0 denotes none,1 denotes primary school, 2 denotes lower middle school, 3 denotes upper middle school,4 denotes technical or vocational degree, 5 denotes the university or college degree, 6 denotes the master's degree or higher;

"mortgage" represents household mortgage condition, where 0 denotes no mortgage and 1 denotes that the family have at least one mortgage; the years of the survey are 2009, 2011 and 2015, where 2009 years as the base period, "t2011" equals 1 when the survey year is 2011 and "t2015" equals 1 when the survey year is 2015; the survey area is divided into 4 parts, northeastern, eastern, central and western China respectively, with northeastern China as the base. $X_{j,i} \ln H_i$ denotes the combined term of virtual variables and the log of house value.

$$\ln C_i = \alpha_0 + \alpha_1 \ln H_i + \alpha_2 \ln Y_i + \sum_{k=1}^{m} \alpha_{k,i} X_{k,i} + \sum_{j=1}^{l} \alpha_{j,i} X_{j,i} \ln H_i + \varepsilon_i \qquad (17)$$

where j≠k.

By estimating the coefficient of the combined term, we can further test the housing wealth effect in different genders, different ages, different years and different regions. By estimating α_1, we can get the elasticity of household consumption expenditure to changes in housing wealth, and examine housing wealth effect on the microscopic. The test results are listed in table 5.2 (see in appendix).

Model (1) shows that household income and house value have a significant impact on household consumption. The elasticity of consumption to changes in income is 0.63, which means that for every 1% increase in household income, the consumption will increase by 0.63%; the elasticity of consumption to changes in house value is 0.07, which means that for every 1% increase in home value, the consumption will increase by 0.07%. This result is in accordance with the direct wealth effect that residents will increase consumption when their houses are worth more money.

Model (2) shows that among the control variables, the coefficients of “urban”, “age” and “educ” are very significant (1% level); the coefficient of “mortgage” is significant at 5% level; the coefficient of “gender” is significant at the level of 10%; “hhsize” is not significant. Compared with rural households, urban household consumption expenditure is about 50% larger. The consumption expenditure of men is about 6% higher than that of women. With the increase of age and education, the people’s saving rate is increasing and the consumption rate decreased slightly. The consumption expenditure of households with mortgage is about 22% lower than households with no mortgage on average.

Model (3) ~ (6) examine the change of housing wealth effect under different conditions. For urban households, the elasticity of consumption spending to changes in house wealth is about 0.10, which is obviously higher than 0.05 of rural households; the household mortgage has no significant impact on the housing wealth effect. For men, the elasticity of consumption to changes in house value is slightly higher than that of women. Of the regional factors, the housing wealth effect is the most significant in northeast China, followed by the western, central and eastern China in order. In terms of time factors, the elasticity of consumption spending to changes in housing wealth shows a gradual decline. Compared with 2009, the number of housing wealth effect in 2011 decreases by 0.02, and it decreased by 0.09 until 2015, which is to say the housing wealth effect is on a downward trend in recent years and it even became a negative number in 2015.

5.3 Robustness test: house owners and the houseless

There are 210 pieces of data provided by houseless people in the total sample with a sample size of 9231. So if we take a contrast of house owners and the houseless, we can find that there is a totally different way on how housing wealth effect functions.

Table 5.3: Estimates of house owners and the houseless

	total sample	house owners	the houseless
R2	0.1808	0.1815	0.1418
constant	1.1061***	1.0289***	4.8804**
	5.9	4.2	3.98
lnY	0.6310***	0.6365***	0.3402***
	38.74	28.61	3.41
lnH	0.0589***	0.0603***	-0.2634
	15.5	14.38	-0.95
hhsize	-0.0023	-0.0028	0.0479
	-0.23	-0.28	0.65
urban	0.5037***	0.5097***	-1.5533***
	9.43	8.05	-5.12
gender	-0.0647*	-0.0628**	0.1235
	-1.95	-2.04	0.61
age	-0.0063***	-0.0062***	-0.0154**
	-6.31	-6.1	-2.19
educ	-0.1023***	-0.1015***	-0.1908*
	-6.74	-6.07	-1.94
mortgage	-0.2184**	-0.2186*	
	-2.18	-1.83	

Method: robust least squares

Note: *,**,*** denote significance at the 10,5,1 percent level respectively. T statistics are below the coefficients.

There are two major differences between house owners and the houseless. First, for every 1% positive shocks to house value, the house owners will increase around 0.06% consumption while the houseless tend to cut spending on consumption since they do not own houses and when the house appreciates, they will have to pay more rents. Another difference is that

people who live in cities without houses spend much less on consumption compared with the houseless living in the countryside, which is on the opposite with house owners. A possible reason may be that rents in cities are much higher than that in countryside, crowding out quite an amount of consumption, which is consistent with the budget constraint effect as mentioned before. When 210 pieces of houseless data are removed from the data sample, the estimation results change little compared with the original sample estimates, so we can say the former results are robust.

6. Conclusion

To some extent, the results of micro models in this paper are consistent with that of macro models. The overall housing wealth effect in China is around 0.06 and there is a difference as large as 0.05 between town and countryside. The micro evidence shows that the housing wealth effect on household consumption is generally positive, differing from regions, years, gender, education and other factors. The micro evidence also finds that for people who own houses and people who are houseless, the impact of a shock to the housing assets value on consumption could be completely opposite.

After 2013, the housing wealth effect shows a trend of weakening in recent years, especially in 2015, when the elasticity of consumption to changes in housing wealth is negative. Possible reasons of the decreasing housing wealth effect may include: first, the sample amount after 2013 is quite small, which could make the results are less credible; second, for the sake of government intervention, the housing price is deviating from the market price, and consumers

expect this policy will not have a long-term impact on their wealth; third, the housing wealth effect is limited compared with income effect, so when people's income is growing at a high speed, consumption will keep growing even their assets do not appreciate; finally, it is possible that the consumption habit is changing in recent years because the Internet finance is popular in China and more people begin to accept credit consumption when can get easy credit at online shopping.

Reference

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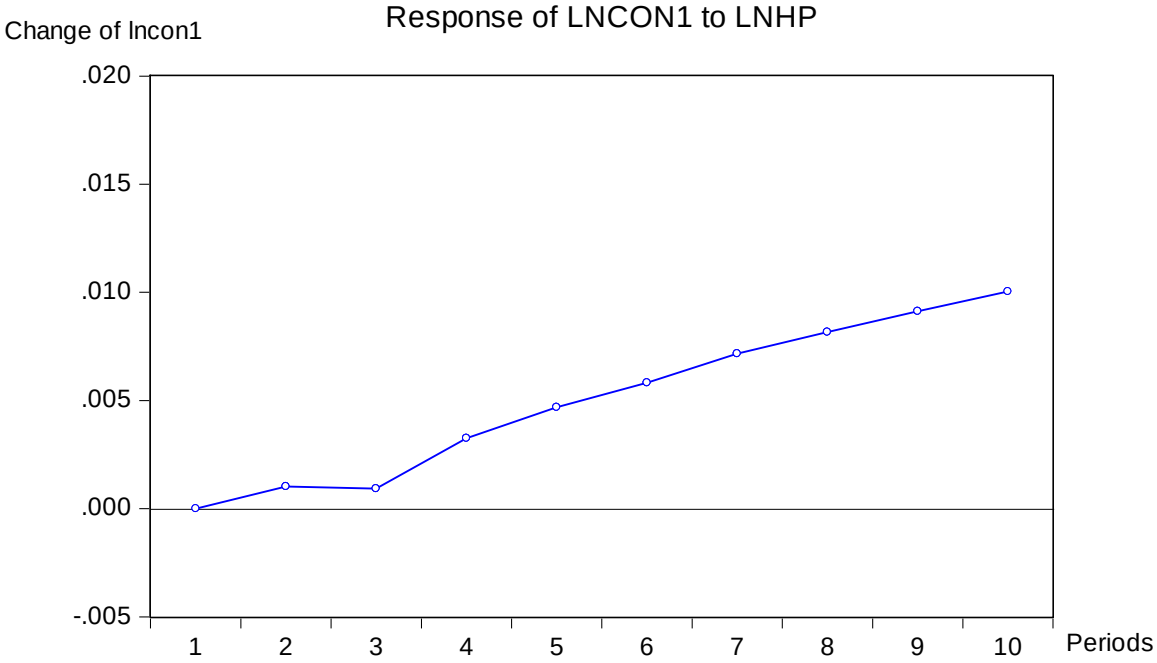
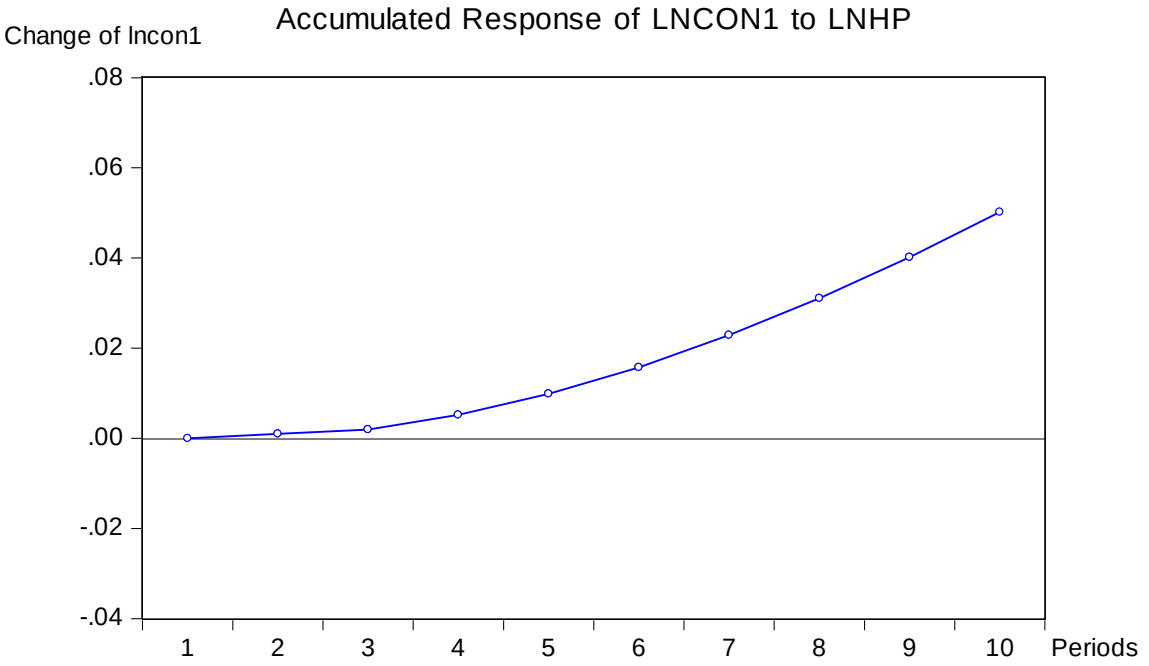
Appendix

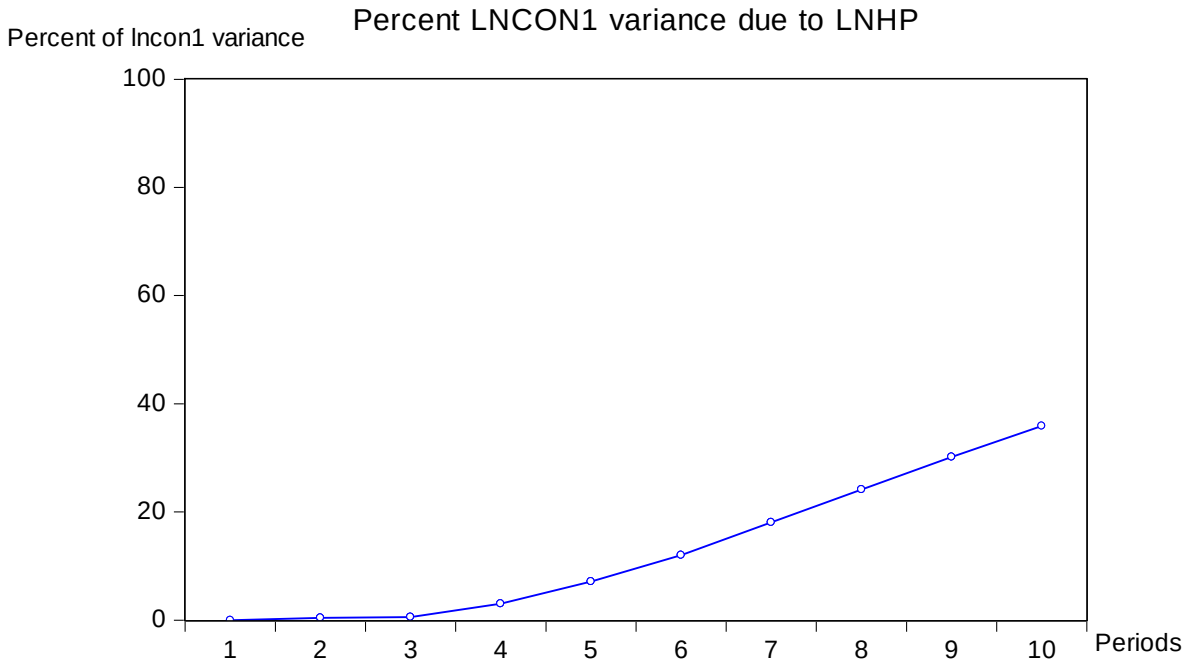
Table：Impulse response and variance decomposition

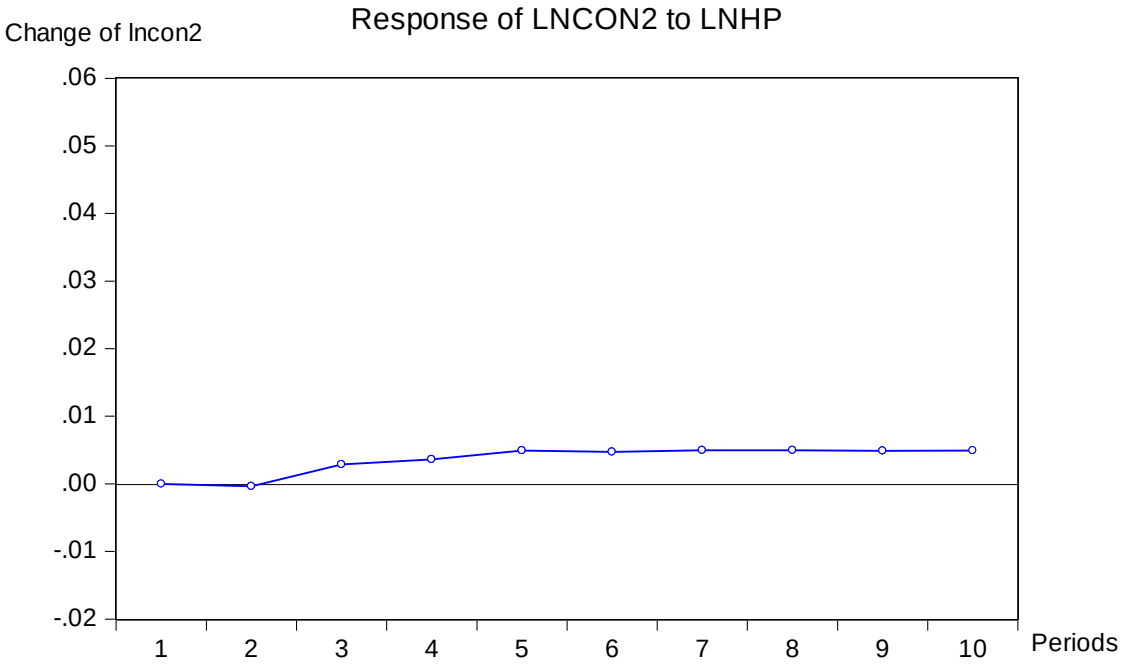
	lncon1			lncon2		
Periods	Impulse response	Accumulated response	Variance decomposition (%)	Impulse response	Accumulated response	Variance decomposition (%)
1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.0010	0.0010	0.4306	-0.0003	-0.0003	0.0024
3	0.0009	0.0020	0.5586	0.0029	0.0025	0.0993
4	0.0033	0.0052	3.0307	0.0036	0.0062	0.1811
5	0.0047	0.0099	7.1191	0.0049	0.0111	0.3001
6	0.0058	0.0157	12.0287	0.0047	0.0158	0.3622
7	0.0072	0.0229	18.0651	0.0050	0.0208	0.4159
8	0.0082	0.0310	24.1700	0.0050	0.0257	0.4552
9	0.0091	0.0402	30.1869	0.0049	0.0306	0.4822
10	0.0100	0.0502	35.8860	0.0049	0.0355	0.5044

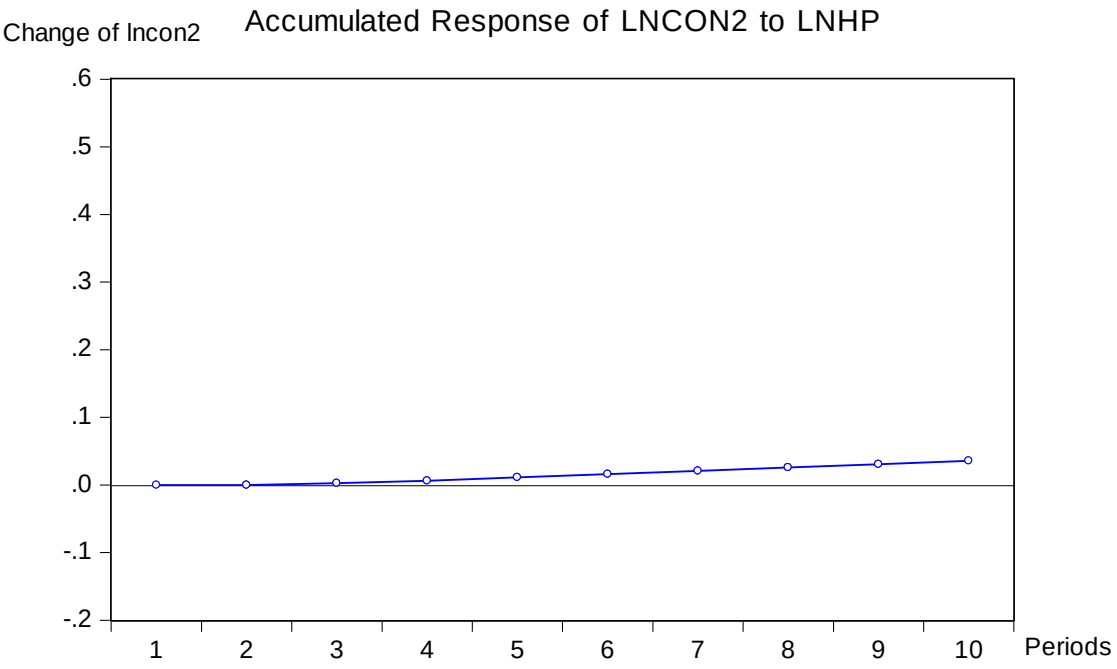
Figure 4.2.1 to 4.2.6






Percent LNCON1 variance due to LNHP
Percent of lncon1 variance
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
10
Periods


Response of LNCON2 to LNHP
Change of lncon2
.06
.05
.04
.03
.02
.01
.00
-.01
-.02
1
2
3
4
5
6
7
8
9
10
Periods


Accumulated Response of LNCON2 to LNHP
Change of lncon2
.6
.5
.4
.3
.2
.1
.0
-.1
-.2
1
2
3
4
5
6
7
8
9
10
Periods

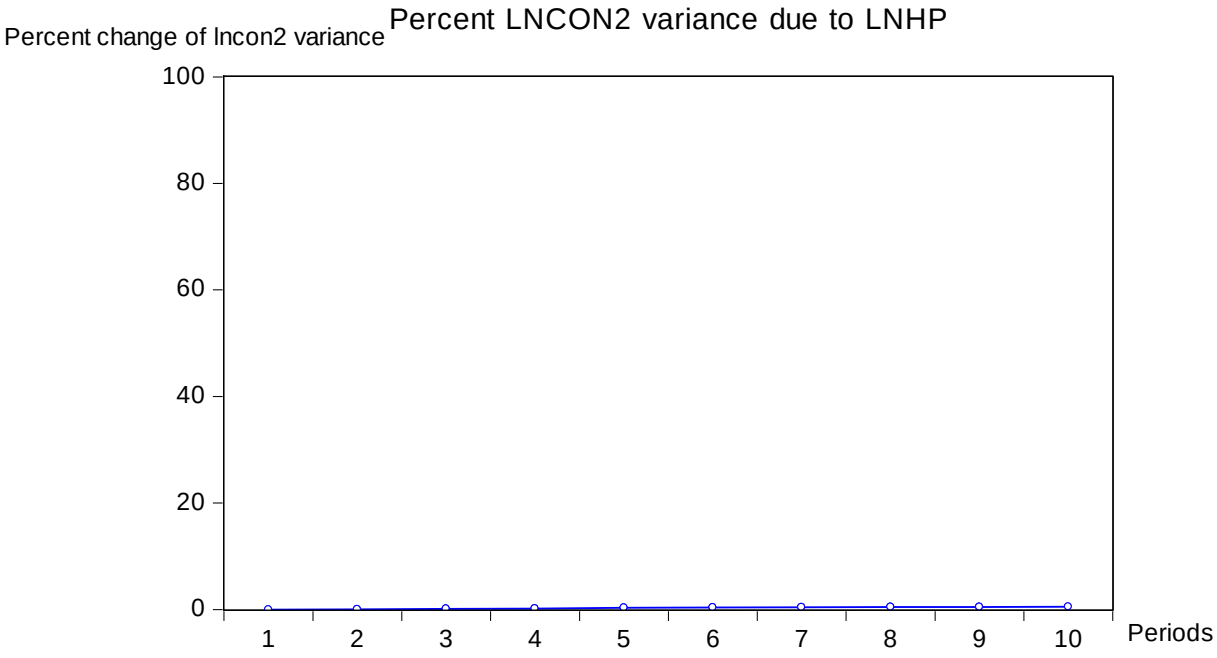

Percent LNCON2 variance due to LNHP
Percent change of lncon2 variance
100
80
60
40
20
0
1
2
3
4
5
6
7
8
9
10
Periods

Table 5.1.1: Descriptive statistics of transformed CHNS data

Variable	Dscription	n	Mean	Std.Dev.	Min	Max
lnC	log of yearly consumption	9231	7.89	1.74	1.90	14.11
lnY	log of yearly income	9231	10.69	1.06	0	14.24
lnH	log of housing assets value	9231	8.10	4.51	0	16.20
hhsize	num. of family members	9231	4.04	1.68	1	15
urban	living in the urban area	9231	0.11	0.32	0	1
gender	0 for male, 1 for female	9231	0.49	0.50	0	1
age	age	9231	44.21	17.34	4	100
education	the highest level of education attained	9231	1.71	1.17	0	6
mortage	1 for mortage	9231	0.03	0.16	0	1
t2011	1 for year 2011	9231	0.34	0.47	0	1
t2015	1 for year 2015	9231	0.42	0.49	0	1
east	1 for living in the east	9231	0.15	0.36	0	1
mid	1 for living in the mid	9231	0.32	0.47	0	1
west	1 for living in the west	9231	0.26	0.44	0	1

Table 5.1.2: Correlation among variables

	lnC	lnY	lnH	hhsize	urban	gender	age	education
lnC	1.0000							
lnY	0.3678	1.0000						
lnH	0.1437	-0.0950	1.0000					
hhsize	0.0652	0.1672	-0.0198	1.0000				
urban	0.1395	0.0993	0.1277	-0.0497	1.0000			
gender	-0.0089	-0.0230	0.0529	0.0312	0.0046	1.0000		
age	-0.0939	-0.1048	-0.0380	-0.2308	-0.0053	-0.0207	1.0000	
education	0.0110	0.2309	-0.2178	0.0347	0.1183	-0.1294	-0.1941	1.0000
east	-0.0110	0.0991	-0.0204	-0.0399	0.0562	-0.0075	0.0540	0.1006
mid	-0.0415	-0.0018	-0.0309	0.1486	-0.0150	-0.0025	-0.0231	0.0414
west	-0.0409	-0.0717	0.0225	0.1402	0.1130	-0.0014	-0.0509	-0.0860
t2011	0.0522	-0.0680	0.6264	-0.0539	0.0666	0.0448	0.0162	-0.1749
t2015	-0.1247	0.1606	0.9534	0.0647	-0.0697	-0.0538	0.0118	0.2746

	east	mid	west	t2011	t2015
lnC					
lnY					
lnH					
hhsize					
urban					
gender					
age					
education					
east	1.0000				
mid	-0.2954	1.0000			
west	-0.2552	-0.4123	1.0000		
t2011	0.0472	-0.0938	0.0033	1.0000	
t2015	0.0528	0.0315	0.0075	-0.6061	1.0000

Table 5.2: Estimates of households' consumption (total sample)

	Model(1)	Model(2)	Model(3)	Model(4)	Model(5)	Model(6)
R2	0.1675	0.1808	0.1810	0.1803	0.1807	0.1928
constant	0.5482***	1.1061***	1.1331***	1.1098***	1.0722***	1.1211***
	3.14	5.9	6.03	5.91	5.75	5.93
lnY	0.6337***	0.6310***	0.6318***	0.6302***	0.6311***	0.6417***
	40.28	38.74	38.81	38.69	38.75	39.16
lnH	0.0694***	0.0589***	0.0544***	0.0586***	0.0618***	0.0713***
	18.86	15.5	13.95	15.36	14.77	10.61
hhsize		-0.0023	-0.0024	-0.0026	-0.0024	0.0220**
		-0.23	-0.24	-0.25	-0.24	2.09
urban		0.5037***		0.4949***	0.5031***	0.6041***
		9.43		9.25	9.42	11.12
gender		-0.0647*	-0.0628*	-0.0650**		-0.0634*
		-1.95	-1.89	-1.96		-1.93
age		-0.0063***	-0.0062***	-0.0062***	-0.0062***	-0.0058***
		-6.31	-6.25	-6.23	-6.26	-5.82
educ		-0.1023***	-0.1013***	-0.1029***	-0.1020***	-0.0894***
		-6.74	-6.68	-6.77	-6.72	-5.85
mortgage		-0.2184**	-0.2354**		-0.2188**	-0.1919*
		-2.18	-2.34		-2.18	-1.91
lnH*urban			0.0490***			
			9.60			
lnH*mortgage				0.0000		
				0.995		
lnH*gender					-0.0062*	
					-1.75	
lnH*east						-0.0375***
						-6.47

lnH*mid	-0.0314***
	-6.60
lnH*west	-0.0267***
	-5.32
lnH*t2011	-0.0199***
	-5.27
lnH*t2015	-0.0946***
	-6.83

Method: robust least squares

Note: *,**,*** denote significance at the 10,5,1 percent level respectively. T statistics are below the coefficients.