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HOUSING PRICES AND CONSOUMPTION:

THE CASE OF CHINA

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HOUSING PRICES AND CONSOUMPTION:

THE CASE OF CHINA

by

WANG Yonglin

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ABSTRACT

Housing Prices and Consumption: The Case of China

by

WANG Yonglin

Master of Philosophy

The rapid soaring housing prices in Chinese residential property market have attracted increasing worldwide attention in recent years. Facing the rising concerns about both the stability and sustainability of Chinese housing market prices dynamics, this study aims at investigating the impacts of changes in housing wealth on consumption in China.

Previous studies on this subject usually use country level data with relatively shorter sample period, or individual time series for a single or a few cities. Recent development in literatures suggests that panel data have the more heightened capacity for modeling the complexity of human behavior than a single cross-section or time series data can possibly allow. In this study, in order to identify both long-term and short-term elasticity of consumption with respect to housing wealth, panel framework of ECM is constructed, with quarterly data from 23 cities throughout China, covering the period of 2005Q1-2010Q4.

The estimation results confirm large and highly significant positive housing wealth effect on consumption in both long-run and short-run for China. Furthermore, due to the potential endogeneity problem driven by the fact that housing prices are highly correlated with income, instrumental variable estimations are also implemented. The resulting empirical findings confirm that changes in housing values can exert large and positive impacts on household consumption, even after this potential endogeneity bias is controlled for.

Key words: housing wealth effect, consumption, ECM, endogeneity bias.

DECLARATION

I declare that this is an original work based primarily on my own research, and I warrant that all citations of previous research, published or unpublished, have been duly acknowledged.

_____

(WANG Yonglin)

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CERTIFICATE OF APPROVAL OF THESIS

HOUSING PRICES AND CONSOUMPTION: THE CASE OF CHINA

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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Chapter 1: Introduction.

The dramatic soaring housing prices in China have attracted global attention in recent years. Private transferable housing prices in first tier cities (including Beijing, Shanghai, Shenzhen and Hangzhou), according to China Real Estate Index System (CREIS), have more than doubled in the last quarter in 2010 since the beginning of 2005; as Figure 1- Figure 3 illustrate, the prices in second tier cities like Dalian, Nanjing and Suzhou even have tripled during these five years. Facing China's unprecedented high growth rate in housing prices, this thesis is motivated by the following three facts: Firstly, according to official statistics, home ownership rate in China is as high as 85%. Hence, it is reasonable to expect that housing wealth accounts for a dominating share of overall household wealth. Such kind of wealth will be very sensitive to the fluctuations of housing prices; Secondly, various theoretical and empirical analyses show that the movements of housing prices can affect consumers' expenditure through the housing wealth effect. Therefore, housing prices dynamics are expected to influence economic growth through this consumption channel, although the sign and the size of the effect are yet to be identified for China. Particularly, in view of the recent government intervention policies that aim at cooling down Chinese housing markets, the corresponding impacts of the depreciated housing prices on consumption and even the whole economy are worth studying; finally, existing literatures on Chinese housing markets mainly focus on issues related to price bubbles. The limited studies on housing wealth-consumption nexus normally apply outdated and country level data. Most importantly, all of them fail to control the endogeneity bias that caused by the potential high correlation between income and housing prices. Consequently, the housing wealth effects on consumption in Chinese housing markets are still under-

researched. This thesis will investigate the impacts of changes in housing prices on aggregate consumption in China with and without controlling for the potential endogeneity problem.

The thesis will proceed as follows. Chapter 2 provides an overview of Chinese housing markets; Chapter 3 discusses literatures of both theories and empirical evidences, particularly the transmission channels of housing wealth to consumption; Chapter 4 describes the theoretical model; econometric methodology employed and data description will be articulated in Chapter 5 and Chapter 6; Chapter 7 reports the empirical results, and Chapter 8 concludes with some implications from the results concerned together with some further extensions of this study.

Chapter 2: Current status of Chinese housing market.

Chinese housing market has its unique features; home ownership rate is at a high level in China, meanwhile housing wealth has dominating share of overall household wealth. Housing reforms, drastic soaring housing prices and speculative housing demand made the pre-mature Chinese housing market even more complicated. This chapter presents an overview of current status of Chinese housing market.

2.1. China sees its unprecedented high growth rate in housing prices in the past decade.

As mentioned before, the dramatic rise in Chinese housing prices is now attracting global attention. Figure 1- Figure 3 present an overview of the latest housing price trends since 2005 by three tiers of cities across China[1]. Noticeably, there exist great gaps in housing prices between each tier and yet the differences are getting larger, particularly, first tier cities hit their peak at RMB 18,900 per square meter in 2010 Q1, which thrice the max of third tier cities at the same time. In addition, housing prices appear to be more volatile in first tier cites compared to that in the other two tiers of cities, this is probably because house purchases occurred in these cities are more likely investment or speculation-oriented. Thus their price level could be more sensitive to external shocks including the global financial crisis and related macroeconomic adjustment policies. Furthermore, there are large differences between housing prices and per capita disposable income, especially in first tier cities. Since the unit of housing prices shown in Figure 1- Figure 3 is RMB per square meter, given the normal size of 50-square meters' private house, the actual gaps between the prices of a house and consumer income level are thereby even larger.

[1] Here cities are categorized into three tiers according to their housing prices level.

These results may be consistent with the finding of Wu, et al. (2010). They computed the price-to-income ratio in eight major cities across China, among which Beijing has the ratio of 15 to 18.5 since middle 2009 and Shenzhen has the highest ratio of approximately 22 in the first quarter of 2010. The ratio hovered around 11 to 14 in Shanghai and Hangzhou. Housing prices in third tier cities, however, keep following their mild upward path together with disposable income, whose strong growth sometimes even exceed housing price appreciation. In all cases, consumption expenditure gently rises alongside disposable income.

Evidences are also provided by Wu, et al. (2010), as the Constant Quality Price Index across 35 major Chinese cities[2], which suggest that real (housing) prices increased by about 225% in the first quarter of 2010 since the year 2000. Furthermore, more than 60% of that appreciation occurred after 2007 Q1. They conclude that home prices in china are now at their all-time highs, and there is no sign of slowdown for the housing prices yet. In particular, the ratio of price-to-rent based on the detailed micro data on prices and rents of owned and rented units increased by almost 75% since 2007 Q1 in Beijing, reaching 45.9 in 2010 Q1, and in other seven large cities the rise of the ratio ranges from 30% to 70%. Moreover, housing prices vary significantly throughout China. This large jump in housing price again raises the concerns on Chinese citizen's affordability for housing and potential housing market bubbles.

Therefore, in view of this big disparity in housing price movement (along with income and consumption level) amongst cities across China, country level data is more likely to under-estimate the volatilities of housing prices in some cities and thus the housing price curve derived for the whole country appears to be smoother with

[2] This price index is calculated by the Institute of Real Estate Studies at Tsinghua University. See Wu, et al. (2010) for more detailed citation.

more moderate increases. Consequently, the use of the national average or aggregate data is more likely to give misleading results, hence inappropriate.

2.2. Real estate financing.

Aiming at relaxing the burden from the rapidly surging housing prices for urban residents, the housing Public Accumulation Fund (PAF) was launched in 1991. Similar to the social security program in the US, the PAF receives funds from employee-payroll deductions and matching funds from employers at about 5 percent of employee salaries. In general, there are mainly two types of ways of real estate loans access to individual for their house financing, as summarized by Fung, et al. (2006), personal housing accumulation fund loans and personal housing loans, among which the former type that derived from PAF can be applied by employees (who have been contributing to the housing PAF) for housing purchase, building, rebuilding or renovation. Alternatively, citizens can also apply for the personal housing loan which, similar to the personal housing accumulation fund loan, has the maximum term of thirty years with all interest rates set by the People's Bank of China (PBC), and there is little difference across banks offering such loans. Even though, Chamon and Prasad (2008) concluded that financing remains limited in China and consequently, instead of borrowing against future income to purchase durable goods, Chinese households are more likely to rely on their savings. As Figure 6 presents, self-raising funds accounts for an ever larger proportion of sources of funds of enterprises for real estate development compared to domestic loans during the past decade in China.

2.3. Housing wealth dominates overall household wealth.

Housing goods have a dual nature of both commodities and investment asset. It is claimed that housing as wealth normally accounting for a much bigger fraction of household net worth than corporate equity (Poterba, et al. (1991). Based on a household survey on financial services in China conducted in 2009, Figure 4 describes Chinese household domestic asset distribution indicating the dominating share (nearly 72%) of their overall asset holdings is accounted for by real estate assets. Contrarily, stock assets take up much less proportion of 11.44%, only 2% higher than that of bank saving. This may be a reasonable explanation for the puzzle that the consumption markets in China are now witnessing their thriving growth even facing the large downturn in stock market.

2.4. China has high home ownership rate driven by housing reforms.

Home ownership rate in China is at a high level. Figure 5 shows the average home ownership rate for the households in the sample survey conducted by Chamon and Prasad (2008), and the proportion of households that own or partially own their homes increased dramatically from 17 percent in 1990 to 86 percent in 2005. A household survey on financial services in China conducted in 2009 supports this argument by reporting the close home ownership rate, as 85.3% of the households in the sample of 10,043 households are home owners. This high home ownership rate is largely attributed to a series of housing reforms in the past three decades, which brought about considerable impacts on the wealth of urban households. In particular, in July 1994 the State Council of China identified the commercialization of urban housing system throughout the country. This privatization of public housing allow individuals living in state-owned housing units to purchase full or partial property

rights of their current houses at the prices that far below their market values, which means Chinese people are allowed to become property owners, and this housing reform has brought about a comparably high home ownership rate in China.

Chinese housing markets have their unique feature since on the one hand, while the house ownership rate in China is at a high level, the living conditions are relatively less desirable. A large number of homeowners who are suffering from poor living environment are planning to trade up as housing prices increase, since the capital from cashing out the old houses is more or less enough for the down payment for the new house. Therefore housing, to a large extent, is still a basic demand in China.

On the other hand, there is an even stronger speculative demand for housing in China, as the proportion of investment oriented house purchasing witnesses a steady growth in the passing few years. Chinese real estate market is believed to have a close linkage with the recent large inflow of speculative capital, commonly referred to as "hot money". Prasad and Wei (2005) notice that ever since 2003, there has been a huge capital inflow into China that can't be explained by trade surplus or foreign direct investment. Zhang (2008) reportedly estimates that $1.75 trillion in "hot money" could have accumulated from 2005 to the first quarter of 2008. House purchasing somehow is believed to be a desirable carrier for this capital. Guo and Huang (2010) identify that the speculative capital flow has aggravated short-term property prices and enhanced the volatilities in both real estate and stock markets in China, and hot money ranks as the second largest contributor in the fluctuations of China's real estate prices. Chu and Sing (2004) believe that the growth of real estate prices in China is largely driven by significant influx of foreign capital into the market. Therefore, real estate has switched its identity from a totally public good

twenty years ago to a commercial product nowadays (Fung, et al.,2006), and the privatization effort has driven the growth of the real estate industry and has made it possible for many modern business practices to be introduced into China. After the housing reform in the 1990s which aimed to improve housing consumption through privatization of the housing system, the residential property prices maintained a long upward trajectory (Chen, et al., 2009). Gan, et al. (2010) summarize that households affected by the housing reform had a significantly higher level of durables consumption than those unaffected.

In light of the combination of the dominating proportion of housing assets in overall wealth, the high home ownership rate and various types of housing demands, household wealth become largely sensitive to the fluctuations in housing prices. Theoretically speaking, the fluctuations in housing asset price can affect households' consumption through the housing wealth effect: increasing house prices lead to a raise in housing wealth, which in turn increases consumption. (I will elaborate this housing wealth-consumption transmission mechanism later in Chapter 3). As consumption is the key component of aggregate demand, if housing prices and consumption are proved to be closely linked in this study, then facing with the housing prices dynamics the corresponding impacts on the sustainability of economic growth and the whole economies are worth noting.

Chapter 3: Literature review.

Theoretically speaking, the fluctuations in housing asset price can affect households' consumption through the housing wealth effect: increasing house prices lead to a raise in housing wealth, which in turn increases consumption. As consumption is the key component of aggregate demand, the views on the role between housing market and economic activities, especially the impacts of housing wealth on consumption, have been widely and intensively analyzed. There are literatures of both theories backup that discuss the transmission mechanisms of housing wealth and consumption linkage, and also empirical evidences with estimated marginal propensity to consumption (MPC) with respect to housing prices.

3.1. Literature review: theories of housing wealth-consumption nexus.

As the correlation of housing wealth/prices and consumption is observed and reported worldwide, how exactly do housing prices affect consumption? Previous literatures (See for instance:Ludwig and Sløk (2002); Aoki, et al. (2004); Iacoviello (2004) and Campbell and Cocco (2007)) categorize some transmission mechanisms from changes in housing prices to changes in consumption as follows:

3.1.1. Realized and unrealized wealth effects.

Firstly, the increase of house wealth/price enriches house owners' net wealth, given the possibility that they will take out equity in the form of refinancing or cash in the housing capital gains, the consumption expenditure is expected to rise. Contrarily, if households choose not to cash in the housing capital gains even though the prices grow up, the owners still have an optimistic expectation for the future due to the increased discounted value of the future wealth. Hence the belief that they are

"richer" than before is likely to boost consumers spending as homeowners are willing to reduce their precautionary saving needs.

3.1.2. Collateral constraints effect.

Given the financial system is well functioned, the rise in house prices makes more collateral available to homeowners, which accordingly may enable them to take more loans against the growing housing wealth. For example, according to Aoki, et al. (2004), in UK, an increase in housing price may encourage homeowners to borrow more in the form of mortgage equity withdrawal (MEW), and to finance desired levels of consumption and housing investment. Iacoviello (2004) develops a two-agent, dynamic general equilibrium model which provided an estimate of how an appreciation in housing prices can be a true driving force of consumption boost when more borrowing allowed. Edelstein and Lum (2004) state that if homeowners are eligible to take loans accordingly to the enhanced housing collateral or to extract accumulated housing equity, "paper" capital gains become a source of realizable purchasing power to finance consumption expenditures.

3.1.3. Budget constraints effect.

For those house renters or potential house buyers, however, the increasing housing prices might cause a "forced saving" through the realized capital losses and consequently dampen their consumption expenditure. Interestingly, there are also evidences showing that higher housing prices would reduce instead of enhance the savings rate of renters. Skinner (1989) concludes that housing price increase causes a significant decline in aggregate saving as homeowners without bequest motive spend down their housing windfall gains. Yoshikawa and Ohtaka (1989) find that higher housing prices lowered the savings rate among Japanese renters since more households were induced to give up the plan to purchase a house, which in turn led to

higher consumption. Engelhardt (1994) also derives the similar conclusion that high house prices considerably reduce the probability of saving for a down payment in Canada.

3.1.4. Substitution effect.

More generally, facing with the soaring housing price, consumers who are planning to purchase a home are likely to suffer from higher down payments and future loans. Hence, they may be forced to cut consumption by switching their consumption choice from high-price goods to low-price one as they struggle to maintain living standards, consequently, this substitution effect force households to either buy a smaller house or to lower private consumption.

In addition, there is ever increasing attention on possible impacts of upward housing price on consumption driven by the bequest motive, which is strengthened by tax laws that favor holding appreciated assets until death (Case, et al. (2005). Phang (2004) consider the failure discovery of impacts from housing wealth on aggregate consumption in Singapore as partially attributable to the stronger bequest motives by homeowners. Edelstein and Lum (2004) also verify that many Asian households tend to be reluctant to "trade down" into a smaller and less expensive home since they intend to leave the house as bequests. As Skinner (1989) argues, homeowners with bequest motive may save more to assist their children in buying the now more expensive housing rather than spending their windfall gains.

3.1.5. Ambiguous housing wealth effects on consumption?

It is worth noting that Buiter (2008) argues that there is no net housing wealth since the inhabitants of a country, on average, own the houses they live in, and every tenant on average is his/her own landlord and vice versa. A housing price decline redistributes wealth from homeowners to tenants. By developing the Yaari-

Blanchard OLG model, the change in housing wealth is proved to affect consumption if and only if it is due to a change in the speculative bubble component of housing prices, rather than the fundamental value—that is— the present discounted value of its future actual or imputed rentals plus a speculative bubble component, if any.

Sinai and Souleles (2005) point out that homeowners with a long expected tenure are perfectly hedged against fluctuations in rents and the corresponding fluctuations in house prices. However, since owners are assumed to have to live somewhere, thus those who experience an appreciation in home prices are also facing an equivalent increase in their future rental liabilities and housing costs. This conclusion suggests little if any wealth effect from housing, as any increase in "wealth" is offset by an increase in housing liabilities. Such offsetting effects reduce the overall wealth effects from changes in house prices.

To sum up, while the realized and unrealized gains due to the appreciation of housing price plus the collateral constraints effect all lead to positive effect on consumption, the budget constraint and substitution effect more likely work in an opposite way. However, there are also chances that housing prices exert little impact on consumption due to the offsetting effect from corresponding liabilities, or the fundamental value components. In addition, as there exist several transmission mechanisms behind the housing-consumption linkage, a number of contributing factors need to be taken into consideration: for example, as Chen (2006) classified, the degree of financial market liberalization, availability of mortgage refinancing tools, culture of bequest, demographic composition, pattern of income distribution and governmental housing policy, etc. Therefore, the aggregate effect must be identified through empirical analysis, and the investigation of the extent that the

fluctuations of housing wealth affect the trend movements of China's household consumption is thus required.

3.2. Literature review: empirics.

Existing literatures on this subject can be categorized into two opposite arguments: some are supporting the existence of housing wealth effects by providing empirical evidences from both macro and micro aspects; more specifically, they also estimated marginal propensity to consumption (MPC) out of changes in housing prices sometimes by comparing the wealth effects from financial assets and housing assets. The other studies, however, also based on their empirical analysis would doubt or even totally deny the presence of housing wealth effects. The remaining part of this chapter list related results from previous studies according to their arguments.

3.2.1. Housing wealth effects do exist.

One of the most widely cited paper concerning housing wealth effect is from Case, et al. (2005), who find a strong correlation between aggregate house prices and aggregate consumption in a panel of 14 countries, where the estimated elasticity ranges from 0.11 to 0.17, and between 0.05 to 0.09 for US states. Recently, Case, et al. (2011) re-examine this nexus by extending their sample of Panel of US states period up to 2009, and yield to a wider range of estimated elasticity between 0.064 and 0.193. Ludwig and Sløk (2002) conduct a similar study of 16 OECD countries, which reports that the effect of housing price on consumption is significantly positive, and such impact of an increase in house price is generally higher in countries with a market-based financial system than those with bank-based system. In UK, Muellbauer and Murphy (1997) also recognize the significant contribution of the rise in housing wealth to the consumption boom during the 1980s. Ho and Wong

(2008) focus on Hong Kong economy, where exports, according to their analysis, drive housing prices which in turn drive domestic demand. That is to say, housing appears to serve as an important link between exports and domestic expenditures. Chen (2006) re-examines the association between housing wealth and aggregate consumption in Sweden market and estimates the long-run elasticity of total consumption with respect to net housing wealth is positive and strong-reaching 0.11.

The estimation from Dvornak and Kohler (2007) report that a permanent increase in housing wealth of one dollar increases annual consumption by around 3 cents by utilizing a panel in Australia states. Edelstein and Lum (2004) compare the estimated link between consumption expenditure and both private and public housing wealth in Singapore and found that changes in private house prices had no significant effect on aggregate consumption while public housing wealth effects are larger and more persistent. Carroll, et al. (2006) develop a new method for estimating the size of wealth effect on aggregate consumption by constructing a model of habit formation, which allows for the possibility that changes in wealth can exert impacts on consumption. Again, the conclusion indicates a substantially larger housing wealth effect compared to stock wealth effect, as the immediate (next-quarter) marginal propensity to consume (MPC) with respect to housing wealth in US is estimated at around 0.02, and the long-run effect is approximately 0.09.

Using micro level data that derived from individual household survey, Skinner (1989, (1993) use US data from the Panel Study of Income Dynamics (PSID) find housing wealth had a small but significant impacts on consumption, and the marginal propensity to consume (MPC) from housing wealth in US was roughly 6 cents per dollar of housing wealth; Engelhardt (1996) estimates the MPC out of real housing capital gains is 0.03 for the median saver household, although asymmetric response

to housing capital gains and losses might be involved. Campbell and Cocco (2007) reply on UK Family Expenditure survey and yield an economically and statistically significant large house price elasticity of consumption for older homeowners comparing to the smallest elasticity for young renters, which is insignificantly though. Bostic, et al. (2009) assemble the US household Data Survey of Consumer Finance and the Consumer Expenditure Survey over the 1989-2001 period, and the research finding indicate relatively large housing wealth effects as the elasticity is estimated in the range of 0.06, compared to that of financial wealth at 0.02. Gan (2010) reports a significant effect of housing wealth on consumption in Hong Kong by utilizing a large panel dataset that tracks the housing wealth and spending behavior of nearly 12,400 homeowners over 12 quarters during 2000 to 2002, more importantly, the finding identifies a reduction of precautionary saving to be the main driver of the housing wealth effect on consumption, and the impacts could be at substantial level even without refinancing and relaxation of credit constraints, with the elasticity at 0.17 when variables are measured at difference level.

3.2.2. Housing wealth effects do not exist.

Contrarily, doubt concerns the existence of such wealth effect also arose from empirical studies on housing wealth-consumption nexus. An early study by Elliott (1980) suggests that fluctuations in the net value of households holdings of real estate do not significantly relate to the changes in consumer spending. Evidence from an investigation of the behavioral life-cycle savings model by Levin (1998) indicates that while consumption spending is sensitive to changes in income and in liquid assets, it is not very sensitive to changes in the value of other types of assets including houses. Phang (2004) confirms that the dramatic increases in house price and housing wealth in Singapore had no significant positive effect on aggregate

consumption, and such failure might be attributed to difficulties from institutional factor in withdrawing housing equity to finance consumption. Calomiris, et al. (2009) question that existing studies (for example the most widely cited paper by Case, et al. (2005, Case, et al. (2011)) that utilize error correction model may suffer from severe problem of endogeneity due to the correlation between housing wealth and permanent income. More specifically, when controlling for the endogeneity bias, the housing wealth effect on consumption would disappear. Consequently, in order to avoid this potential endogeneity bias, a more reliable model, as I will discuss later, is required to be constructed under a Permanent Income Hypothesis (PIH) framework, with valid control instruments incorporated.

3.3. Related literatures concerning housing wealth effect in Chinese markets.

By contrast, studies concerning housing wealth-consumption nexus in Chinese housing markets are relatively less to be found in international literatures.

A recent study by Wu, et al. (2010) provide new evidence on Chinese housing bubbles by computing the ratio of price-to-rent and the ratio of price-to-income in eight cities major cities in China. Specifically, the price-to-rent ratio in Beijing jumped by almost three-quarters from 26.4 in 2007 to 45.9 in the first quarter of 2010, and the ratio in Hangzhou has more than doubled to 65.5 in 2010Q1 from 31.8 in 2007Q1; other cities including Shanghai and Shenzhen have also seen their price-to-rent ratios rise sharply to over 40. By contrast, Chengdu, Tianjin, Wuhan and Xi'an have lower price-to-rent ratios and the appreciation rates ranging from 28% (Wuhan) to 78% (Tianjin). The authors suggest that the declines in expected appreciation rates is yet another indication of the importance of the expectations of continued high price appreciation in Chinese housing markets, since even 4% appreciation in

expected home values, in Beijing for example, would drive over 40% drop in housing prices. As to price-to-income ratio, Beijing has the ratio of 15 to 18.5 since middle 2009; Shenzhen has the highest ratio reaching 22 further in the first quarter in 2010; housing prices have hovered between 11 and 14 times income in Shanghai and Hangzhou.

As a driving force of the soaring housing prices, land values in Beijing have substantially ascended by nearly 800% since 2003, according to the constant quality land price index produced by Wu, et al. (2010); particularly, the research findings from their hedonic model imply that state-owned enterprises (SOE) are strongly responsible for this appreciation as they paid 27% more than other bidders for an otherwise equivalent land parcel.

Another literature concerning Chinese housing markets is from IMF working paper by Ahuja, et al. (2010) which investigate the problem of overvaluation (undervaluation) and misalignment in housing prices. They provide two approaches for benchmark prices measurement: one is a panel regression based on 35 cities using quarter level data of 2000-2009, linking prices to long-run fundamentals including GDP per capita, lending interest rate, land price index, population density of city and stock index. The results signify that as a whole property prices appear to be in line with long-run equilibrium values, although the prices in some big cities like Beijing, Shanghai, Shenzhen are out of line with long-run equilibrium fundamentals; pieces in cities such as Nanjing, Qingdao even appear to be somewhat undervalued with respect to their long-run fundamentals recently; the other one is the asset pricing approach, which relies on the relationship between price, rent and ownership cost implied by efficient markets. This method aims at gauging how far market prices may be deviating from benchmark levels, and again, limited deviations from the

benchmark measure in the overall Chinese housing markets have been detected, prices are roughly aligned with benchmarks. As the exceptions, mass-market housing prices in Shanghai and Shenzhen, as well as high-end prices in Beijing and Nanjing, do appear to be increasingly disconnected from fundamentals as they were 10 percent further deviated from benchmark level in 2010.

As a further analysis, Ahuja, et al. (2010) use panel data at provincial level from 1994 to 2008 to explore to what extent property price changes may affect private consumption, whereas the estimated impacts turns to be insignificant. Contrarily, the effect on private investment and local government revenue are sizable.

Literatures concerning the wealth effects in Chinese housing markets are found to be limited. There are numbers of literatures on this subject written in Chinese, which, unfortunately, generally employ outdated country level data or pure time-series data of several cities within a relatively shorter sample period, and the estimations are most likely derived under a simple OLS and single Error Correction Model. The regression results, as a consequence, vary considerably from each other, both in terms of magnitude and sign, although they all conclude the presence of housing wealth effect in China. Table 1 presents a summary of existing studies written in Chinese mentioned above.

Chen, et al. (2009) who construct a Vector Error Correction Cointegration model and verify the existence of a unique long-run relationship between household consumption, disposable income, financial wealth and housing wealth in urban China, although housing wealth is the only factor that restores the long-run equilibrium relationship when facing external shocks. In addition, the utilization of Permanent transitory Variance decomposition analysis identifies that a large proportion of variance in the short-run movements of housing wealth is found to be transitory.

Chen, et al. (2009)'s work, however, does not consider the potential endogenous problem rose from the high correlation between income and housing prices. Hence the estimated housing wealth effect with the absence of controlling for this endogeneity bias would be highly questioned. (See Calomiris, et al.,2009). Accordingly, the housing wealth-consumption nexus in Chinese markets is still under-researched. The aggregate effect must be identified through empirical analysis, and the investigation of the extent that the fluctuations of housing wealth affect the trend movements of China's household consumption is thus required. Consequently, in order to avoid this potential endogeneity bias, a more reliable model, as I will discuss later, is required to be constructed under a Permanent Income Hypothesis (PIH) framework, with valid control instruments incorporated.

Chapter 4: Theoretical model.

Before proceed to any empirical analysis, it is necessary to describe a theoretical framework that supports the hypothetic linkage between housing wealth, consumption and income. Existing literature (see Lettau and Ludvigson (2004) for example) has already provided such models to deduce household prove the consumption-wealth ratio, and the later includes housing wealth. Therefore this Chapter will present a summary or overview of the exiting theory on this.

Consider an economy with a representative in which all wealth, including human capital, is tradable. Let $\boldsymbol{W_t}$ be aggregate wealth (human capital plus asset holdings) in period$\boldsymbol{t}$. $\boldsymbol{C_t}$ is consumption and $\boldsymbol{R_{w,t+1}}$ is the net return on aggregate wealth. The accumulation equation for aggregate wealth with budget constraint may be written as:

$$\boldsymbol{W_{t+1} = (1 + R_{w,t+1})(W_t - C_t)} \quad (1)$$

For convenience, lowercase letters are used to denote log variables throughout this chapter. Defining $\boldsymbol{r = log(1 + R)}$ **,** Campbell and Mankiw (1989) derive an expression for the log difference consumption-aggregate wealth ratio by taking first-order Taylor expansion of the budget equation (1) can be expressed as:

$$\boldsymbol{\Delta w_{t+1} \approx k + r_{w,t+1} + \left(1 - {1}/{\rho_w}\right)(c_t - w_t)} \quad (2)$$

Where $\boldsymbol{\rho_w = \frac{W-C}{w}}$ is the steady-state ratio of new investment to total wealth, $\boldsymbol{k}$ is an unimportant constant. By imposing $\boldsymbol{lim_{i\to\infty}\, \rho_w^i(c_{t+i} - w_{t+i}) = 0}$, the log consumption-wealth ratio is now written as:

$$\boldsymbol{c_t - w_t = \sum_{i=1}^{\infty} \rho_w^i \left(r_{w,t+i} - \Delta c_{t+i}\right)} \tag{3}$$

In light of the fact that equation (3) holds simply as consequence of the agent's intertemporal budget constraint and therefore holds both ex post and ex ante, conditional expectations can be taken on both sides of the above equation:

$$\boldsymbol{c_t - w_t = E_t \sum_{i=1}^{\infty} \rho_w^i \left(r_{w,t+i} - \Delta c_{t+i}\right)} \tag{4}$$

Where $\boldsymbol{E_t}$ is the expectation operator conditional on information available at time $\boldsymbol{t}$, and $\boldsymbol{\Delta c_{t+i}}$ is the rate of growth of consumption between $\boldsymbol{t}$ and $\boldsymbol{t+i}$. As aggregate wealth, especially human capital is not observable, Lettau and Ludvigson (2004) describe the nonstationary component of human capital:

$$\boldsymbol{h_t = k + y_t + z_t} \tag{5}$$

where $\boldsymbol{y_t}$ denotes aggregate labor income, $\boldsymbol{z_t}$ is a mean zero stationary random variable, and k again, is the unimportant constant. Therefore total wealth may be approximated as:

$$\boldsymbol{w_t \approx \omega a_t + (1-\omega) h_t} \tag{6}$$

Where $\boldsymbol{a_t}$ is the asset holdings, and $\boldsymbol{\omega = \frac{a_t}{w_t}}$ stands for the average share of asset holdings in total wealth. Correspondingly, the log returns of these types of wealth taking the form:

$$\boldsymbol{r_{w,t} \approx \omega r_{a,t} + (1-\omega) r_{h,t}} \tag{7}$$

Hence, substituting equation (5) and (7), (4)is now transformed into:

$$\boldsymbol{c_t - \omega a_t + (1-\omega) y_t} \\ \boldsymbol{= E_t \sum_{i=1}^{\infty} \rho_w^i \{ [\omega r_{a,t+i} + (1-\omega) r_{h,t+i}] - \Delta c_{t+i} \} + (1-\omega) z_t} \tag{8}$$

As all the items on the right side of equation (8) are presumed to be stationary, $\boldsymbol{c_t}$, $\boldsymbol{a_t}$ and $\boldsymbol{y_t}$ must be cointegrated, and the left side provides the deviation in common trend of $\boldsymbol{c_t}$, $\boldsymbol{a_t}$ and $\boldsymbol{y_t}$. Therefore, any deviation from the long-run ratio of consumption and wealth should predict rate of return on wealth, income and rate of growth of consumption, and consumption (as well as wealth) should be able to adjust to correct for the long-run equilibrium.

Chapter 5: Empirical methodology.

Following established procedures, this chapter will explore whether upward movement in housing prices and income stimulate or dampen consumer spending in China with a panel error correction model. As the prerequisite, firstly it is necessary to test the order of integration in housing prices, income, consumption and control variables; next, panel cointegration test is carried out to identify the presence of long-run relationship amongst them, once which are proved to be cointegrated, then it can proceed to the error correction model analyzing the long-run equilibrium and short-run dynamics within these variables; Lastly, in order to keep the ECM estimation results solid and robust, instrumental variable (IV) estimation is thereby called for to control the potential endogeneity problem driven by the high correlation between income and housing prices.

5.1. Panel unit root test.

In general, panel unit root test is based on the following univariate regression:

$$\Delta \boldsymbol{y_{it}} = \boldsymbol{\rho_i y_{it-1}} + \boldsymbol{\gamma_i X_{it}} + \boldsymbol{u_{it}} \tag{9}$$

Where $\boldsymbol{i}$=1,2,…,N stands for the individual, and for each individual $\boldsymbol{t}$=1,2,…,T time series observations are available. $\boldsymbol{X_{it}}$ is the deterministic component that could be zero, one, the fixed effects or individual trend, and $\boldsymbol{u_{it}}$ is the stationary process. If the coefficient $\boldsymbol{\rho_i}$=0, $\mathbf{y_i}$ is suggested to be nonstationary and has a unit root; while if $\boldsymbol{\rho_i}$<0, series $\mathbf{y_i}$ is weakly trend-stationary.

The panel framework can provide dramatic improvements in power compared to performing a separate unit root test for each individual time series. Among the current different approaches for panel unit root test, Levin, et al. (2002) test, Breitung

(2000) test and Hadri (2000) test assume that the coefficient $\boldsymbol{\rho_i = \rho}$ for all $\boldsymbol{i}$, which means $\boldsymbol{y_{it-1}}$ is homogeneous across all cross-section units of the panel and that individual processes are cross-sectionally independent. The Im, et al. (2003) (IPS approach), however, suggest a new more flexible and computationally simple unit root testing procedure for panels (which is referred as *t*-bar statistic), that allows for simultaneous stationary and non-stationary series. It permits individual unit root processes so that $\boldsymbol{\rho_i}$ is a heterogeneous coefficient of $\boldsymbol{y_{it-1}}$ and may vary across cross-sections. This is a more reasonable proposition because heterogeneity could arise from different economic conditions and levels of development in each section.

Instead of pooling the data, IPS consider the mean of ADF statistics computed for each cross-section unit in the panel when the error $\boldsymbol{u_{it}}$ is serially correlated, possibly with different serial correlation patterns across cross-sectional units, and *T* and *N* are sufficiently large. Considering a linear trend for each of the *N* cross-section units, and through substituting serial correlated $\boldsymbol{u_{it}}$, Equation 1 can be transferred into:

$$\Delta \boldsymbol{y_{it}} = \boldsymbol{\alpha_{0i}} + \boldsymbol{\rho_i y_{it-1}} + \sum_{\boldsymbol{i=1}}^{\boldsymbol{p_i}} \boldsymbol{\varphi_{ij}\, \Delta y_{it-j}} + \boldsymbol{\varepsilon_{it}} \qquad (10)$$

The null hypothesis is:

$$\boldsymbol{H_0}: \boldsymbol{\rho_i = 0} \text{ for all } i$$

Against the alternatives:

$$\boldsymbol{H_0}: \begin{cases} \boldsymbol{\rho_i < 0 \text{ for } i = 1, \dots N_1} \\ \boldsymbol{\rho_i = 0 \text{ for } i = N_1 + 1, \dots N} \end{cases} \text{ with } \boldsymbol{0 < N_1 < N}$$

IPS computes separate unit root tests for the N cross-section units and define their *t*-bar statistic as a simple average of the individual ADF statistics $\boldsymbol{t_{iT}}$, for the null as:

$$\bar{t} = \frac{1}{N}\sum_{i=1}^{N} t_{iT} \tag{11}$$

In light of the heterogeneous nature of the alternative hypothesis, rejection of the null hypothesis does not necessarily imply that the unit root null is rejected for all *i*.

5.2. Panel cointegration test.

If it is concluded from the previous unit root test that all the series are integrated of order one, then next stage proceeds to the utilization of cointegration techniques to test for the existence of long-term relationship among integrated variables. One of the most prevail approach is Pedroni (1999, (2000) procedure, which is the residual-based tests for the null of no cointegration for panels in which the estimated slope coefficients are permitted to vary across individual members of the panel. This approach includes seven different test statistics which evaluate the null hypothesis of no cointegration against both the homogeneous and heterogeneous alternatives. The total seven statistics can be grouped into two types of statistics, the four in first type (panel cointegration statistics) are based on pooling the residuals of the regression along the within-dimension of the panel, and the other three in second type (group mean panel cointegration statistics) are based on pooling the residuals of the regression along the between-dimension of the panel. Each of these statistics is shown to have a comparative advantage in terms of small sample size and power properties depending on the underlying data-generating process. The principle involves first to estimate the hypothesized cointegration relationship separately for each individual panel section and then to pool the resulting residuals for conducting the panel tests.

5.3. Error Correction Model (ECM).

The well-established model proposed by Ando and Modigliani (1963) is suitable for the analysis of economic growth and fluctuation:

$$\boldsymbol{C_t = c_Y Y_t + c_W W_t} \tag{12}$$

Here total consumption $\boldsymbol{C_t}$ is expressed as the function of disposable labor income $\boldsymbol{Y_t}$, and income from wealth $\boldsymbol{W_t}$, which is a substitution of disposable non-labor income or property income . More commonly, this model is widely utilized by further decomposing the income from wealth $\boldsymbol{W_t}$ into subcategories like financial wealth and housing wealth (see for example: Ludwig and Sløk (2002); Chen (2006); Case, et al. (2005), as different types of wealth may cause different effects on consumption through their individual channels.

In this paper, wealth will be focusing on housing wealth, and housing price has been demonstrated to be a good proxy of housing wealth by Chen (2006). In this study, an identical form of the long run consumption function is assumed for all cities, and the long run relationship between consumption, housing price and income is defined as:

$$\boldsymbol{C_{i,t} = \alpha_0 + \alpha_1 H_{i,t} + \alpha_2 Y_{i,t} + \alpha_3 R\_gdp_{i,t} + \alpha_4 fixed\ effects + \varepsilon_{i,t}} \tag{13}$$

Where $H_{i,t}$is housing wealth, *i* and *t* denoted the city and time respectively, $\varepsilon_{i,t}$ is the error term capturing the effects of unexpected shocks to consumption. As housing markets varies among cities in terms of their degree of maturity, the availability to housing loans and the housing price measurement, these differences can be accounted for in the statistical analysis by permitting fixed effects to vary across

cities, therefore city-specific time trends to control for variations over time in each sections is introduced in the model.

The growth rate of Gross domestic product (GDP) of each city, as indicated by $R\_gdp_{i,t}$, is utilized as a control variable to account for their individual economic differences from regional components. As a major macroeconomic characteristic, the growth rate of GDP is a good indicator of the local economy scale and the size of local consumption market. In addition, since the sample period covers certain amount of 'big events' including financial crisis in 2008 and a series of strong policy adjustments on macroeconomic growth from central government. Most importantly, it is believed to reflect consumers' expectation for the growth rate of their future income. The study also includes quarter and city fixed effect to control for the many changes in market and regulatory conditions over time and across cities.

The pooled OLS estimation expressed as equation (13) is expected to indicate the estimated long-run elasticity of consumption with subject to housing wealth (α_1) and income (α_2) respectively. As summarized in Chapter 3, pervious empirical works in this fields suggest that the housing wealth and consumption should be co-move in the same direction, in other words, the impacts of housing wealth on consumption should be significantly positive, although the magnitude could be different across different *i*.

Upon identifying variables being cointegrated and the presence of long-term relationship among them, the next step is to investigate the short-run dynamics within the consumption-housing price nexus. Error correction model (ECM) can measure how consumption performs the adjustments to revert the system back to the new long-run equilibrium. Although Lettau and Ludvigson (2004) point out that vector error correction model (VECM) would be more preferable as it is able to take full account of the dynamic responses of all variables in the cointegrated system and

obtain more robust parameter estimates of the wealth-consumption nexus, the granger causality relationship within these three variables is not the major concern in this study Borrowed from Engle and Granger's (1987) procedure, the first step requires estimating the long-run consumption-income-wealth relationship as describes in equation (13) for the purpose of capturing the estimated residuals.

Followed by Holtz-Eakin, et al. (1988), the short-run consumption equations with residuals from the first-step cointegration equation (13) are specified as follows:

$$\Delta \boldsymbol{C_{it}} = \boldsymbol{\beta_0} + \sum_{\boldsymbol{k=0}}^{\boldsymbol{p}} \boldsymbol{\beta_{1k}} (\Delta \boldsymbol{C_{it-k}}) + \sum_{\boldsymbol{k=0}}^{\boldsymbol{p}} \boldsymbol{\beta_{2k}} (\Delta \boldsymbol{H_{it-k}})$$

$$+ \sum_{\boldsymbol{k=0}}^{\boldsymbol{p}} \boldsymbol{\beta_{3k}} (\Delta \boldsymbol{Y_{it-k}}) + \sum_{\boldsymbol{k=0}}^{\boldsymbol{p}} \boldsymbol{\beta_{4k}} (\Delta \boldsymbol{R\_gdp_{it-k}}) + \boldsymbol{fixed\ effect} + \boldsymbol{\mu_{1i}} \boldsymbol{\varepsilon_{1it-1}} + \boldsymbol{\varepsilon_{1it-1}} \quad (14)$$

Where $\Delta C_{it}, \Delta H_{it}, \Delta Y_{it}\ and\ \Delta R\_gdp_{it}$ are the first differences of consumption, housing price, income and GDP growth rate respectively, and the error correction term $\boldsymbol{\varepsilon_{1it-1}}$ is the residual estimated from the long-run equilibrium equation (13). $\boldsymbol{p}$ is the optimal lag length determined by Schwarz Bayesian criterion or AIC. The coefficient $\boldsymbol{\beta}$ indicates the short-term granger causality relationship between its corresponding independent variable and dependent variable. The parameter $\boldsymbol{\mu}$ is the coefficient of error correction term $\boldsymbol{\varepsilon_{1it-1}}$, and it is expected to be negative, signifying the speed at which dependent variable converts the system back to the new equilibrium path.

5.4. Endogeneity bias control.

Existing studies (eg.Case, et al. (2005, Case, et al. (2011)) that utilize error correction model may suffer from severe problem of endogeneity due, as questioned

by Calomiris, et al. (2009), to the correlation between housing wealth and permanent income. In particular, as Calomiris, et al. (2009) claim, permanent income shocks are sometime considered to be the dominant source of housing price changes across time and across places, and one may ascribe to housing and stock wealth a causal impact on consumption that really reflect expected and unexpected permanent and transitory income. Therefore, without controlling for this endogeneity bias, those results shown large effects from housing wealth on consumption are highly likely driven by correlations between permanent income shocks and housing price changes. As Table 2 indicates, the correlation of housing price and consumption is estimated at 0.5247, and income, as expected, is highly correlated with housing price (at 0.6522) and consumption (at 0.7099). Consequently, in order to avoid the potential endogeneity bias from the correlation between the components of income and housing wealth, a more reliable model is required to be constructed under a Permanent income hypothesis (PIH) framework, with valid control instruments incorporated.

According to Campbell and Mankiw (1990), Calomiris, et al. (2009), etc., for error correction model, lagged difference in income, lagged difference in consumption and lagged difference in housing wealth itself are all valid instrumental variables. Especially, twice-lagged values of the corresponding instruments are adopted to avoid the measurement problem, which is triggered by the fact that data (consumption, income and housing prices) are captured as quarterly averages instead of values at points in time.[3] Hence when dealing with these time-averaged data, lagging the instruments more than one period so that there is at least a two-period time gap between the instruments and other variables in equation (14) would be a valid method. Similarly, two-period lagged income, consumption and housing prices

3 See Campbell and Mankiw (1990) for more articulated explanations.

are adopted as instruments for the long-run equilibrium as expressed in equation (13). Two-stage lest squares (2SLS) regression will be utilized for this instrumental variable (IV) estimation.

Hausman test is subsequently carried out in order to check whether the instruments selected for the endogeneity bias control are exogenous and valid. The underlying idea of Hausman test is to compare two sets of estimates, one of which is consistent under both the null and the alternative and another which is consistent only under the null hypothesis. Hence in this study, Hausman test is capable of identifing whether the 2SLS estimation with instrumental variable correction is preferable to the pooled OLS estimation under the panel eorror correction model framework.

Chapter 6: Data, variables and descriptive statistics.

The study obtains an unbalanced sample of 23 cities with quarterly data for the period 2005Q1-2010Q4. Table 12 provides a description of data availability.

6.1. Housing wealth.

Previous studies all have their individual selections for housing wealth proxy. Chen, et al. (2009) multiplied the average value per square meter of urban housing by per capita urban residential area to obtain the proxy for the per capita values of urban housing assets. Edelstein and Lum (2004) argued that the measure of the wealth can be realized if sellers of public housing were to sell existing units at current market prices and to repurchase a new subsidized unit, so the wealth is computed as the difference of real resale public housing price and real new public housing price multiplied by real transaction volume. Case, et al. (2005) referred the housing wealth to aggregate value of owner occupied housing which is computed by multiplying homeownership rate by number of households and housing price index for country for each section in each period. More often, housing price indices are employed in most previous studies (see for example: Ludwig and Sløk (2002), Phang (2004)).

It is worth mentioning that recently there are two prevalent Chinese housing data sources: National Bureau of Statistics (NBS) and National Development and Reform Commission (NDRC). whereas Property prices reported by NBS, as compared by Ahuja, et al. (2010), tend to be considerably lower than those by NDRC during the same sample period. Apart from statistical caliber, the major factor for this large quantitive difference lies in the number of sampling cities, since NDRC collects all transaction data available in 35 cities while NBS takes 10,000 samples covering 70

cities. Therefore, the national average price data is apt to understate the housing price inflation especially in high-end price cities.

This study adopts the value of private transferable housing (it meant “Shang Pin Fang” in Chinese) prices for each city, which are available from the database in CREIS (China Real Estate Index System). This monthly available data is the selling price of private transferable house with the unit of RMB per square meter, while consumption and income variables at city level are all quarterly data after 2007. Therefore this data frequency inconsistence problem determines our data to be at quarter level. When converting monthly data into quarterly data, however, all those price volatility and useful hidden information is highly likely to be canceled out by merely taking average value over the total three months housing prices, as a result, housing price of the second month of each quarter is selected representing quarterly housing price. Another reason picking the second month data is the fact that that the possible impacts on consumption from housing prices fluctuations are believed to be less prompt compared to that from stock market, consequently the third month data would not be the optimal choice facing such delay effect, which is assumed to last for a month. For comparison purpose, I still report the estimation results computed from the first month third month housing prices respectively, which in turn are also the empirical proof that the second month housing prices is indeed the optimal choice.

6.2. Consumption and income.

As to the issue of different choice of consumption, scholars have discussed widely and insightfully. The argument point focused on durable goods, nondurable goods and their related service flows. One major shortcoming with using total consumption is that it also includes expenditures on housing services, but a number of scholars

(for example: Ludwig and Sløk (2002); Edelstein and Lum (2004); Case, et al. (2005); Chen (2006); Chen, et al,. (2009) still stick to this approach, as argued by Rudd and Whelan (2002) to track the intertemporal dynamics of spending, it is not the stream of service flows but total consumption expenditure that matters.

However, Phang (2004) pointed out that instead of using total consumption, econometric studies of consumption generally use non-durable consumption which excludes durable goods due to the complexities associated with durable goods investment. Also, her study introduced the third way to measure consumption: non-durable consumption less rent and utilities[4], since it excludes consumption of rental housing services. Durable consumption is believed to be inappropriate as one problem concerning is that service flows from durable goods are unevenly spanned over periods and are difficult to measure. (Chen, 2006; Chen, et al., 2009). Considering data availability, the paper use total consumption as consumption measurement, this series is indicated by consumption expenditure per capita, obtained from CEIC Premium China Database and CREIS. In order to keep internal consistency, disposable income per capita serves as the proxy of income, which is also available from CEIC Premium China Database.

6.3. GDP growth rate and fixed effects.

The growth rate of GDP is calculated by quarterly GDP (RMB million) at city level that available from CEIC Premium China Database, CREIS Database, and corresponding municipal bureau of statistics.

All variables including housing prices, consumption expenditure per capita, disposable income per capita and the growth rate of GDP are taken into real terms,

[4] Note that this series also excludes other components of non-housing consumption which might be expected to have a large wealth elasticity of demand (Phang, 2004)

which are all deflated by consumer price index (CPI) that calculated in forms of 2004 Q1-based index. CPI is also obtained from CEIC Premium China Database.

Chapter 7: Empirical results interpretation.

Empirical results are reported in this chapter. To summarize the findings, I find that all series are integrated at order one. Next, panel cointegration test confirms that there exist long-run cointegration relationships amongst all variables. Estimations on panel error correction model lead to the emergence of significant positive housing wealth effects on consumption both in long-run and short-run. Most importantly, when the endogeneity bias is controlling for by incorporating instrumental variables, both long-run equilibrium and short-run dynamics show consistent results, housing wealth effects thereby still positively exert on consumption.

7.1. Panel unit root test.

The results of the IPS test are shown in Table 3. With individual intercept included, all variables at level form are nonstationary in nearly all individual sections (cities), the respective Im, Pesaran and Shin (IPS) W-stats are thereby insignificant; once all series are transformed into their first differences, the test statistics become significant in most of the cities, although some cities still appear to be nonstationary (which may be partially attributed to their short observations). The joint test shown in IPS W-stats is significant, indicating housing prices, income and consumption are thereby proved to be stationary at I(1).

7.2. Panel cointegration test.

Table 4 reports the residual-based cointegration test. According to Pedroni (1999)'s explanation, for the panel variance statistic (shown as the first statistic in within dimension group), large positive values imply that the null of no cointegration is rejected. For any of these latter tests, large negative values imply that the null of

no cointegration is rejected. Hence, four of the seven statistics (plus two out of three in weighted within-dimension group) appear to be negative and large enough to reject the null hypothesis of no cointegration, which confirms the existence of cointegration relationship amongst housing prices, consumption and income.

7.3. The long run elasticity.

The estimation results of the long–run relationship specified in equation (13) are presented in Table 5. It shows that in the long run, housing prices clearly bring significantly positive impacts on consumption in all cases with or without quarter/city fixed effects. The elasticity estimated from the second month housing prices (column 1-4) ranges from 0.09 to 0.23, where noticeably, the coefficients are much larger in magnitude when quarter fixed effect is excluded. The first month and the third month housing prices have similar elasticity of 0.08-0.22 (as shown in column 5-12), and once again coefficients are smaller both in magnitude and significance level when quarter dummies are included. These coefficients of housing prices are generally in line with those estimated by previous researches. For example Case, et al. (2005) find a remarkably strong sensitivity of consumption to changes in housing wealth across countries, ranging from 0.11 to 0.17 upon a panel of 14 countries and 0.05-0.09 upon US cross state data. Recently, Case, et al. (2011) re-examine this link by extending their sample period up to 2009 and yield a slightly wider range of estimated elasticity between 0.064 and 0.193; Ludwig and Sløk (2002) give out the elasticity of consumption with respected to housing prices at 0.0362 by using data for 16 OECD countries from 1985-2000. Income, without any doubt, has a significant strong positive effect on consumption, with the consistent elasticity ranging from 0.4103 to 0.6817. Conclusively, the positive impacts from housing

prices on consumption dominate the negative effects in the long run. Besides, the fact that income elasticity is less than one is consistent with economic theory in a life-cycle model inter alia by Ando and Modigliani (1963) and Gal í(1990).

The wide range of long-run elasticity of consumption with respect to housing prices is endued with further economic meaning. Based on the private transferable housing prices available from CREIS database, Chinese housing prices has the average growth rate[5] of 24.38% in 2010, accompanied by the annual growth rate of 6.96% in consumption expenditure per capita. Given the estimated elasticity of 0.09 (as shown in Column 1, Table 5), for example, the 24.38% increase in housing prices correspondingly leads to 2.19% increase in consumption per capita, which accounting for as much as 31.55% of the annual growth of consumption per capita. In other words, nearly one thirds of the annual consumption expenditure per capita growth in 2010 is attributed to housing wealth effects when both quarter and city fixed effects are taken into consideration; given to the elasticity that estimated from other specifications (as shown in column 2 and column 4 for instance), the consequent fraction could be even larger.

7.4. The short run dynamics.

The statistical results of error correction model (ECM) as specified in equation (14) are reported in Table 6. This ECM represents a co-integrated relation between consumption, housing prices and income. The lag length chosen by AIC is one. The short run changes in consumption at the current period is influenced by the lagged fluctuations from not only itself, but also the lagged changes in housing prices, income, and the error correction term— the disequilibrium factor from last period. In

[5] The country average growth rate of housing prices and consumption in 2010 are derived from author's calculation based on the 23 cities in this sample.

the short run, the current changes on housing prices have significant positive effects on the current changes of consumption, with the marginal propensity to consume (MPC) of 0.12 quarter fixed effects, or 0.21 otherwise. In this case the impacts of immediate changes (with one-quarter lag) in housing prices are smaller but insignificant, which confirm the fact that the influences of the changes in housing prices on consumption are prompt since the effects are visible only within the current quarter, and the aftereffects left in the next quarter are comparatively vague and indistinct. This is probably because homeowners tend to be over-consuming once they witness a housing prices appreciation, and then cut down the expenditure back close to their previous level in the next three months. (Note they still consume more compared to before the value increases since the positive coefficients of one-lag changes in housing prices on current changes in consumption are estimated at 0.023-0.046, although they are insignificant). These estimation results are generally in line with existing studies: Case et al. (2005) present the elasticity of changes in consumption subjecting to housing market wealth are 0.047 and 0.056 from US data, and their resent work in 2011 report the qualitatively close results: 0.045-0.168; similarly the corresponding elasticity reported by Chen (2006) is 0.064 in Swedish market. Comparably, the short run dynamics estimated by first month and third month housing prices have relatively smaller MPC, and the significance levels are accordingly inferior, which once again confirm that applying the second month housing prices is the superior choice, since being the median month throughout a quarter, it is less likely to have post ante or ex ante perspective.

As the deviation from the long-run trend (cointegration residual), the error correction terms from each equations are negative and significant, indicating that consumption, housing prices and income all participant in the disequilibrium

adjustment, as they all work on converting their individual system back to the new equilibrium. In particular, the disequilibrium error in consumption from last period (here is a quarter) is corrected at the ratio of 1.43(with both quarter and city fixed effects are included), and 1.21 (when quarter fixed effects are excluded), which are relatively faster than Swedish level at 0.117 (Chen, 2006).

The significance of the short run dynamic coefficients from VECM could be interpreted as the indicator of causality from independent variable to dependent variable (as suggested by Mahadevan and Asafu-Adjaye (2007)). The presence (absence) of granger causality is listed in Table 6, indicating that there is short run unidirectional causality from housing prices to consumption and income to consumption, which is accord with the intuition and in particular, in line with the confirmations from previous micro studies that the existence of the causal relationship running from wealth to consumption (eg.:Maki and Palumbo (2001)). However, the empirical evidences[6] suggest that neither consumption nor income can granger cause housing prices, as there may involve in a number institutional factors nor the determinants should be more complex.

7.5. Controlling for the endogeneity bias.

This section presents the estimation outcomes of the housing wealth effect on consumption when the potential endogeneity problem is controlled for by employing instrumental variable (IV) approach. Table 7 shows the results from IV estimation on equation (13), where the 2nd through 4th lags value of consumption, income and housing prices are utilized as the endogeneity bias reducing instruments. During the

[6] I did run the estimation the similar equation, with log difference of housing prices being the dependent variable and lagged log difference of consumption being the independent variable, but I choose not to report the results here as the coefficients of key variables are all insignificant.

2SLS estimation procedure, quarter dummies are taken into consideration both in stage 1 and stage 2 estimation, while city dummies are only included in stage 2 estimation. The different combinations of quarter and city fixed effects in stage 1 and stage 2 yield to total of six specifications, as indicated in Table 8, the housing wealth effects on consumption are positive at high significance level (1%) for all cases (column 1-6). As the major focus of this study, these one-percent significant housing price coefficients resulting from endogeneity bias correction model further confirm the presence of housing wealth effect on consumption. Besides, the coefficients have a wide range of 0.20 - 0.43, meaning that at country level, according to the elasticity analysis mentioned before, the annual growth in consumption expenditure per capita driven by housing wealth effects account for as high as 70.11% of the total growth in consumption expenditure per capita in 2010. In other word, comparing to other contributing factors, housing prices appreciation is more likely to dominate the consumption growth.

IV estimation for the short-run dynamics presented in equation (14) brings even more satisfactory results, as reported in Table 9, both current and one-quarter lagged changes in housing prices exert positive impacts on current changes in consumption, except for the case that all quarter and city dummies are included (column 1). This positive short-run marginal propensity to consume (MPC) out of housing prices provides evidence that against the permanent income hypothesis (PIH), which states that hypothetically, the choices made by consumers regarding their consumption patterns are determined not by current income but their long-term income expectations. Hence the transitory, short-term changes in housing wealth gains are supposed to have little effect on consumer spending behavior according this theory. This failure in holding the permanent income hypothesis could be partially attributed

to the collateral constraints effect as discussed in Chapter 3: as consumers are liquidity constrained, appreciated housing values enhance their capability to make loans and also the purchasing power, which consequently stimulate their consumption expenditures not only within the current quarter but also spread into next quarter, although in diminished size, of course.

As a robustness check, I further run the estimation with 2^{nd} through 4^{th}, 2^{nd} through 6^{th} lagged income, lagged consumption, and both lagged income and consumption being instruments respectively. Table 11 summarizes the estimated housing wealth effects for the combinations of city and quarter fixed-effects control, instrument lags (2-4 or 2-6), and the instruments used in addition to lagged housing prices (income, consumption, or both). In all, the coefficients of housing prices are positive and highly significant (at least in five percent) in 22 of the 36 specifications, together with 5 cases that are at 10% significant, although the size still varies substantially from 0.23 to 1.79, again it is the significance of the coefficients that I focus on. The results suggest that even when the endogeneity bias is under control, the housing prices still show large, positive impacts on consumption. As Carroll, et al. (2006) advocate, for monetary policy purposes, the large housing wealth effects on consumption suggest that it is important to pay careful attention on developments in housing markets separately from stock markets in that the possibility of a significantly higher MPC out of housing wealth can shift the balance of risks in a macroeconomic forecast.

Hausman tests on the IV estimations for long-run equilibrium and short-run dynamics are listed in Table 8 and Table 10 respectively. In both cases the null hypothesis that OLS estimator is consistent is rejected, which indicate that 2SLS

approach is preferable to the pool OLS estimation, and the instruments selected are thus proved to be exogenous and valid.

Chapter 8: Concluding Discussions.

In this Chapter, I carry out further analyses on the implications of the empirical results obtained from the previous chapter. It also provides some concluding remarks and point out several directions for future research.

8.1.Summary of empirical results.

This study aims at investigating the impacts of changes in housing wealth on the consumption in China. Although the housing price/wealth–macroeconomy nexus have been widely explored, there is hardly a well-developed model that has been established, especially, related studies on this subject are still under researched. Restricted from data availability, previous researches on Chinese housing market simply use country level data. Since China is a large country with tremendous differences in economic development across regions, there exists a huge disparity between rich and poor, coastal regions and inland regions and the gaps are even intensified these years. Therefore, country level data is more likely to offset the volatilities and thus the curves derived from appear to be smoother and more moderate, consequently, it is not able to reflect the valuable information hidden inside, and the utilization of this sort of data for empirical analysis purpose would be inappropriate. In addition, as recently there is raising concerns that the impacts of housing wealth on consumption may actually be induced by the correlation between income and housing price, the existence of housing wealth effect has been highly questioned.

By constructing a panel framework of error correction model (ECM) with quarterly data (2005Q1-2010Q4) from 23 cities across China, the study analyzes the marginal propensity to consumption (MPC) subject to housing prices both in long-

run and short-run. Empirical results report large and significant positive housing wealth effect on consumption, as the long-run elasticity is 0.09-0.23 and it reaches 0.12-0.21 in short-run dynamics. More importantly, facing the potential endogeneity problem that driven by the fact that housing prices are highly correlated with income, the study takes account this possible endogenous bias by incorporating instruments and thereby, lagged exogenous variables are included. In long-run equilibrium analysis, 2^{nd} through 4^{th} lagged values in consumption, income and housing prices are picked as instruments, and the instrumental variables (IV) estimation presents significant positive housing wealth effects on consumption with wide range in size. The elasticity of consumption subject to housing prices estimated from Pooled OLS suggests that in China, nearly 32% growth in consumption expenditure per capita is induced by housing wealth gains in 2010, particularly, the proportion reaches 71% more based on 2SLS estimation.

The IV estimation based on the short-run dynamics also reports supporting evidence, as in this case, both current changes and one-quarter lagged changes in housing prices have significant positive coefficients on changes in consumption. This failure in holding permanent income hypothesis (PIH) can be partially explained by the liquidity constraints effects: liquidity constrained consumers are able to take more loans according to the appreciated value of collaterals, hence together with the reduced precautionary saving needs, homeowners are thus apt to be stimulated to raise their consumption spending.

As a robustness check, 27 out of 36 specifications still show significantly positive housing wealth effects. Consequently, the empirical analysis reinforce the conclusion that changes in housing values can exert large and positive impacts on household consumption, even when the endogenous bias is strictly controlled for.

There had been a long heated debate among scholars and policy makers that whether the high housing prices benefit the economy as a whole or distort the growth of the emerging market. This study identified the existence of large and positive housing wealth effect on consumption in Chinese housing market, which is a critical channel that housing prices can affect the whole economic growth, and noticeably, in 2010 nearly 32%- 71% increases in consumption are induced by housing capital gains. This conclusion suggests that the appreciation in housing prices stimulate consumers' expenditure, through which macroeconomy may consequently be affected by housing prices since consumption is the key component of economic growth. Therefore risks from the opposite effects are also worth noting. As the bubble components are highly likely to appear in housing price dynamics in some cities of China, if these components continue to grow large and eventually go burst, the consumption could be dampened substantially and corresponding shocks to the whole economy are unavoidable.

8.2.Some policy implications.

The empirical results of this study may have some policy implications. Considering people's house affordability and the potential housing markets bubble in China, government has announced a series of firm intervention policies in order to cool down the "overheated" Chinese housing market. Accompanied by the declined housing prices, aggregate consumption is accordingly dampened since housing prices and consumption, from this study, are proved to be closely related and move at the same direction. In view of the dominating proportion of housing wealth accounts for in the overall household wealth and the fact that the majority Chinese are homeowners (with the home ownership rate as high as 86%), the corresponding

negative effects on consumption from declines in the price level could be even enlarged.

From another aspect, firms normally take mortgage loans by depositing their properties as pledge so that they can borrow capitals according to the value of their collaterals. Similar to the collateral constraints effect discussed in Chapter 3, the depreciated property prices correspondingly reduce their borrowing power and thus constrain their investments. Economic growth may be further dampened due to lower investments from enterprises.

Consequently, governmental adjustments are sometimes considered to be a double-edged sword, on the one hand the soaring housing prices have indeed been temping down, on the other hand economic growth may have been dampened due to the reduced consumption and investments. Therefore once the housing price slumped, economic growth would be dragged sluggishly, with fewer amounts of aggregate consumption and investment value, the chain repercussions may even involves in unemployment problem, and the corresponding shocks to the whole economy could be devastating. Consequently, policy adjustments are necessary to be “soft landing”, in other words, governmental policies are suggested to maintain the sustainability of housing markets and avoid trigging large fluctuations in housing price level.

8.3. Extensions of this study.

As a deeper test of the potential for endogeneity bias, variable consumption can be further categorized into durable and non-durable consumption in that lumpy durables should be more sensitive to the relaxation of borrowing constraints, and hence the corresponding wealth effect exerted would be larger. Non-durable consumption therefore excludes durable goods due to the complexities associated with durable

goods investment. Phang (2004) even introduces a third way for consumption measurement: non-durable consumption less rent and utilities expenditure, which hopefully, can extract pure housing wealth for more precise analysis purpose.

Another extension of this work could take account collateral constrains or mortgage equity withdraw (MEW) effect and explore whether the collateral constrains plays a significant role in consumption and housing wealth linkage. As argued by Ludwig and Sløk (2002), the design of the financial systems has important implications for the strength of the wealth effect, and the change of the impacts of housing prices suggests that financial markets play a crucial role but more research addressing this issue is needed. Chinese government has issued a series of expansionary actions on its emerging housing and financial market, including loosening credit constraints and cutting the entering threshold of bank loan market. Hence through empirically verifying the existence of collateral constraints effect in China, further researches are encouraged to examine the link between housing market and financial market, and also the development extent of Chinese financial liberalization and bank loan system.

Once individual household survey is available, the study may be carried out at micro data level since it permits numerous innovations in the assessment of wealth effects. Micro data within individual household allows for the heterogeneities in demographic factor, consumer habit, etc, and it is liable to distinguish local and national movements, predictable and unpredictable movements in both housing prices and consumption. Consequently, household level data enable us to shed new light on household consumption behavior in wider and deeper research areas, for example, it appears to be preferable as it also conceive the possibility for analysis on asymmetric problem in the response of consumption to positive and negative housing

wealth gains. Again, the measurement of the non-durable consumption and the non-durable consumption excludes rent and utility services, and the collateral constraints approach analysis discussed above are also largely relies on the micro data availability.

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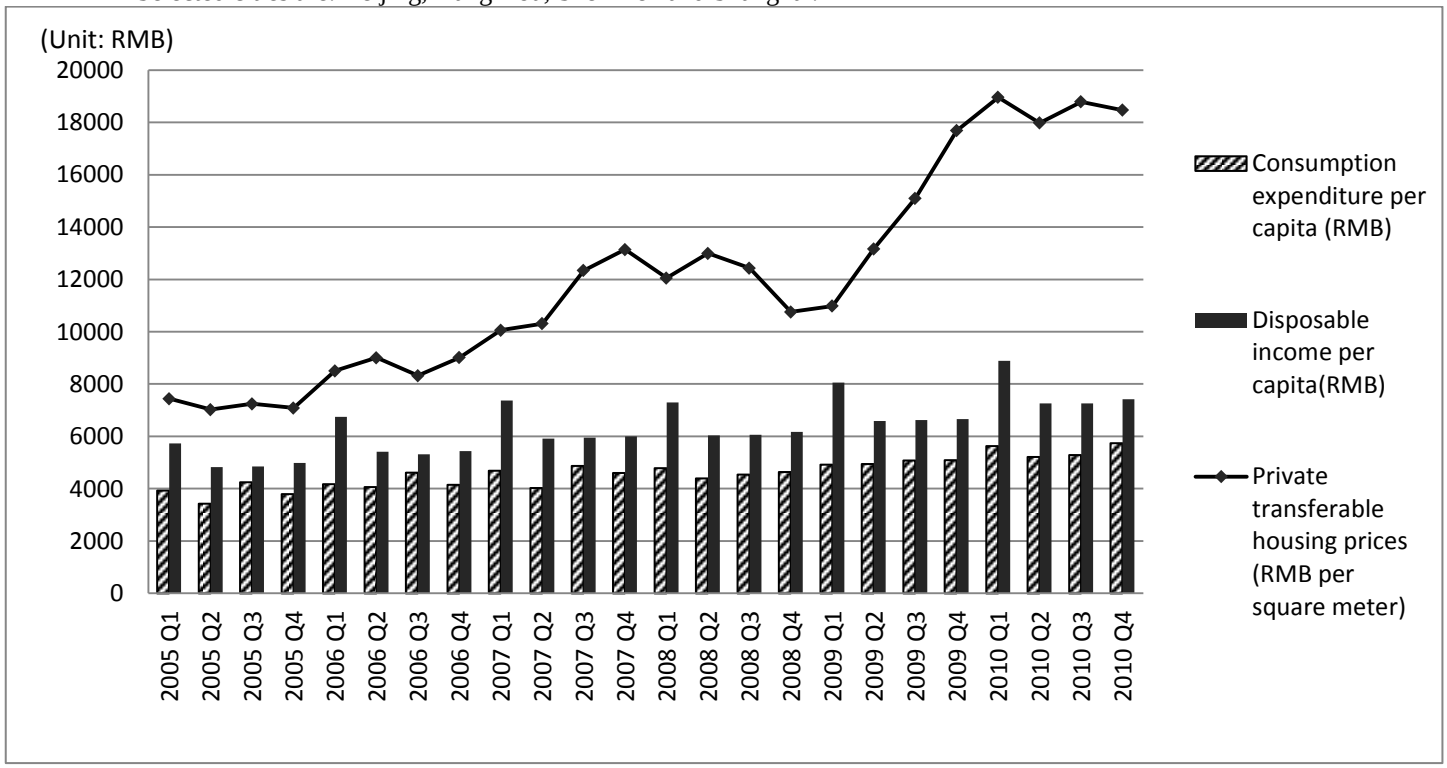
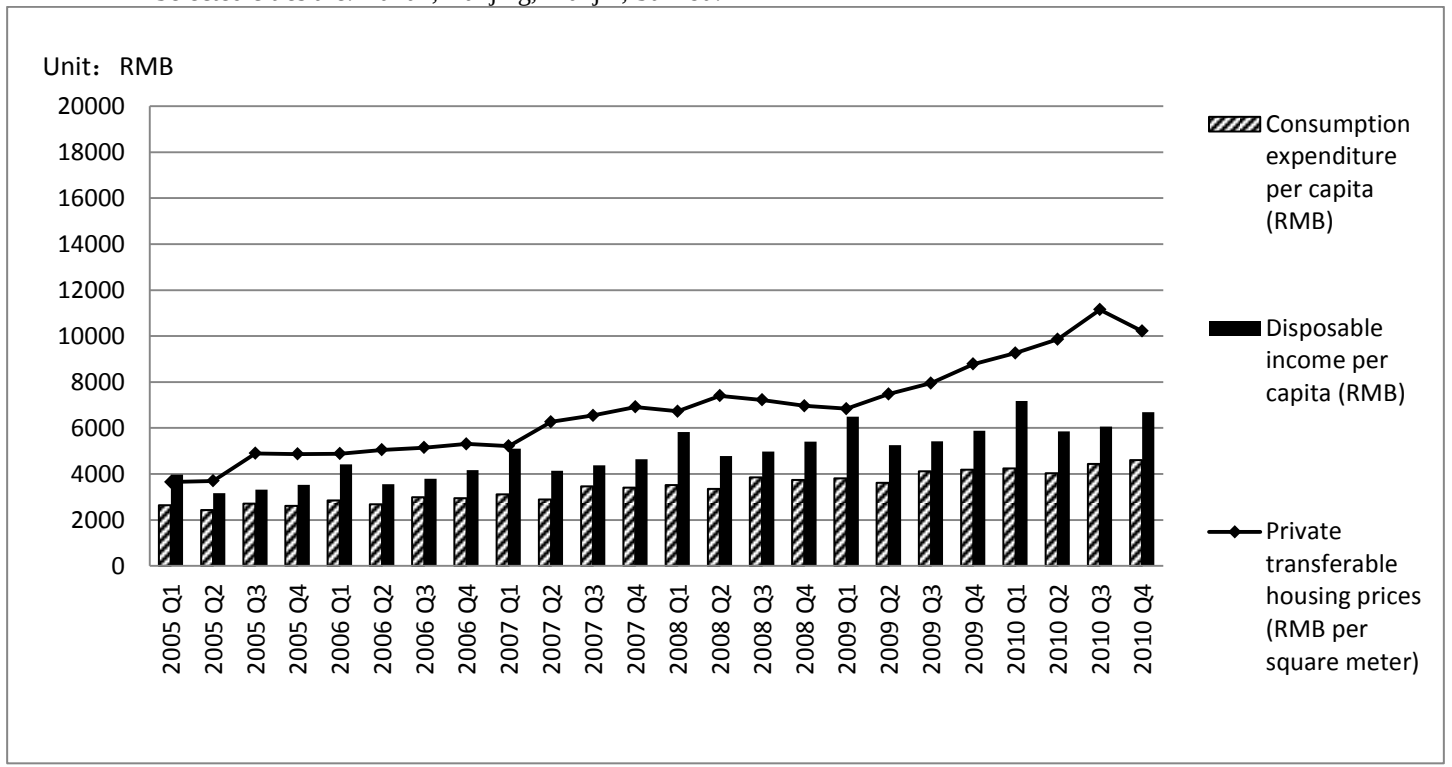
Figure 1: Average prices level in first tier cities.
Selected cities are: Beijing, Hangzhou, Shenzhen and Shanghai.



Data sources: CREIS and CEIC Premium Database.

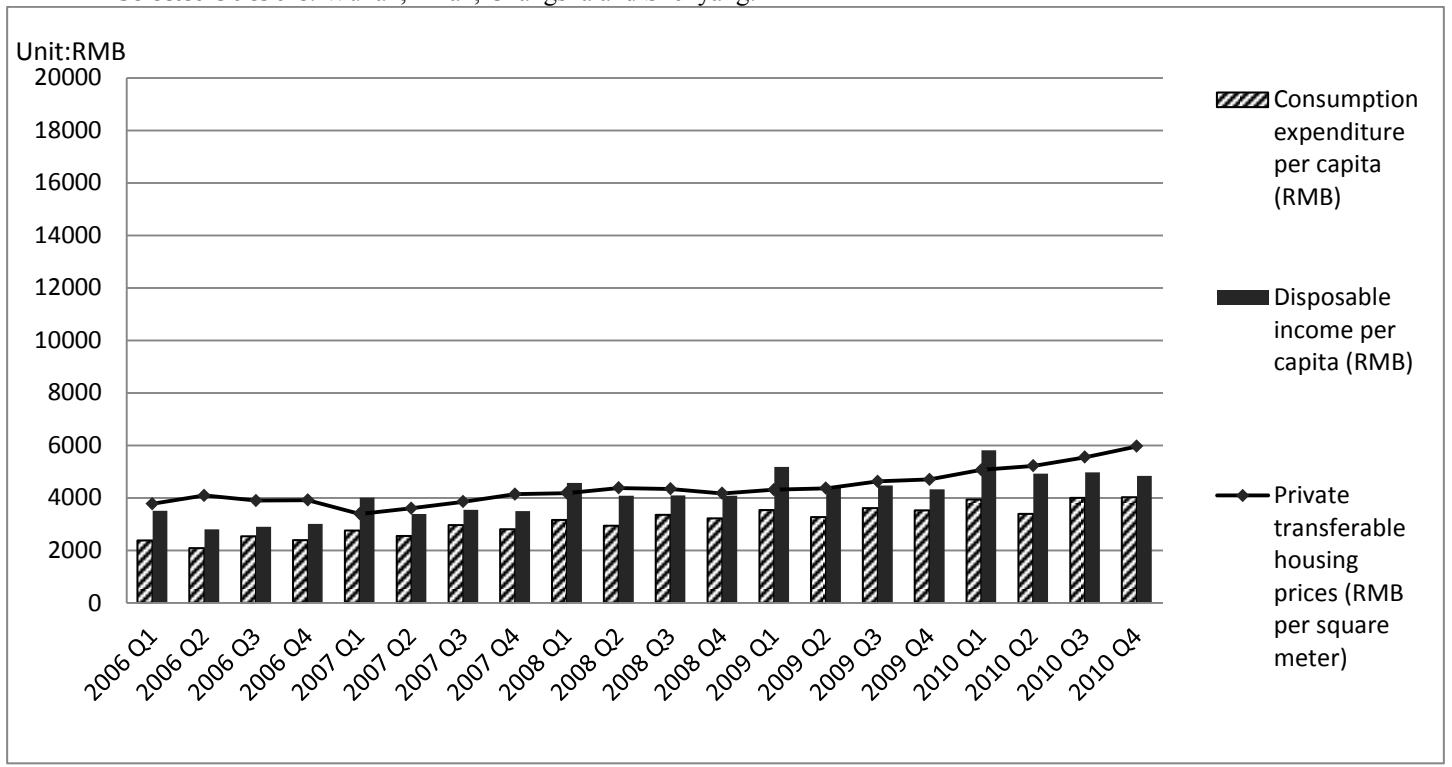
Figure 2: Average prices level in second tier cities.
Selected cities are: Dalian, Nanjing, Tianjin, Suzhou.



Data sources: CREIS and CEIC Premium Database.

Figure 3: Average prices level in third tier cities.

Selected cities are: Wuhan, Xi'an, Changsha and Shenyang.



Data sources: CREIS and CEIC Premium Database.

Figure 4: Household Domestic Asset Distribution in China.

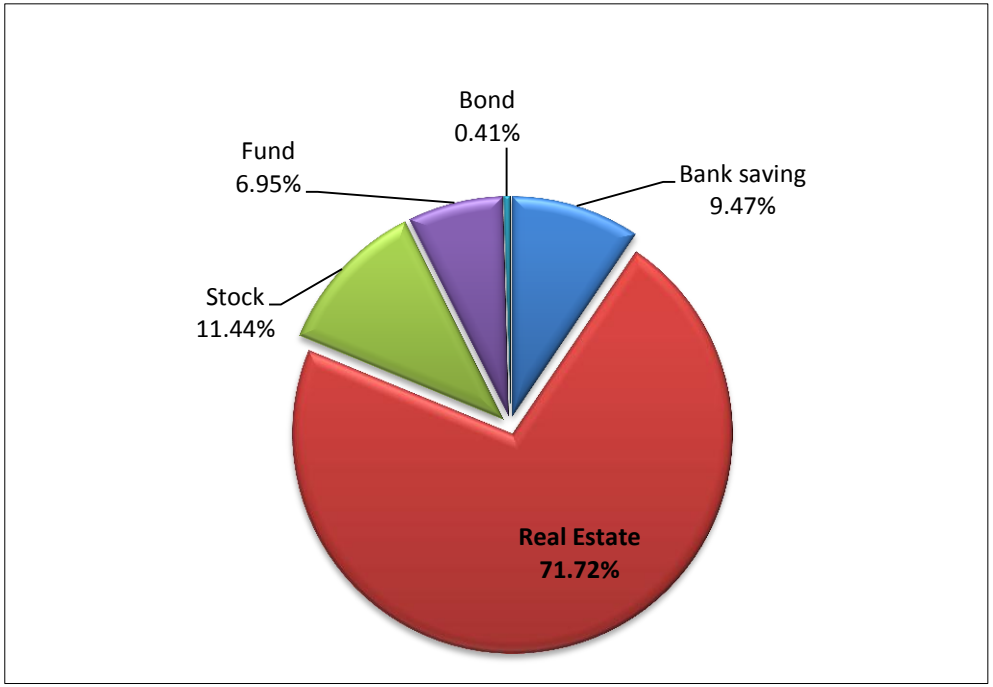


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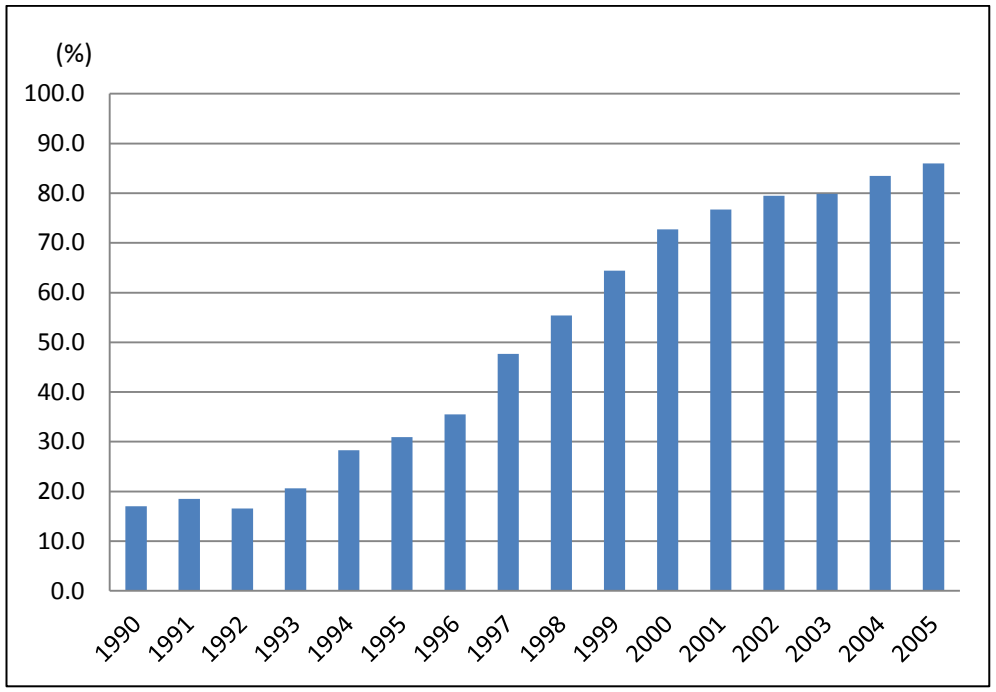
Figure 5: Average home ownership rate for the households in China.



Data Source: Chamon and Prasad (2008). Why are saving rates of urban households in china rising? Brookings Global Economy and Development Paper No. 31

Figure 6: Sources of Funds of Enterprises for Real Estate Development in China.

(Data Source: National Bureau of Statistics of China)

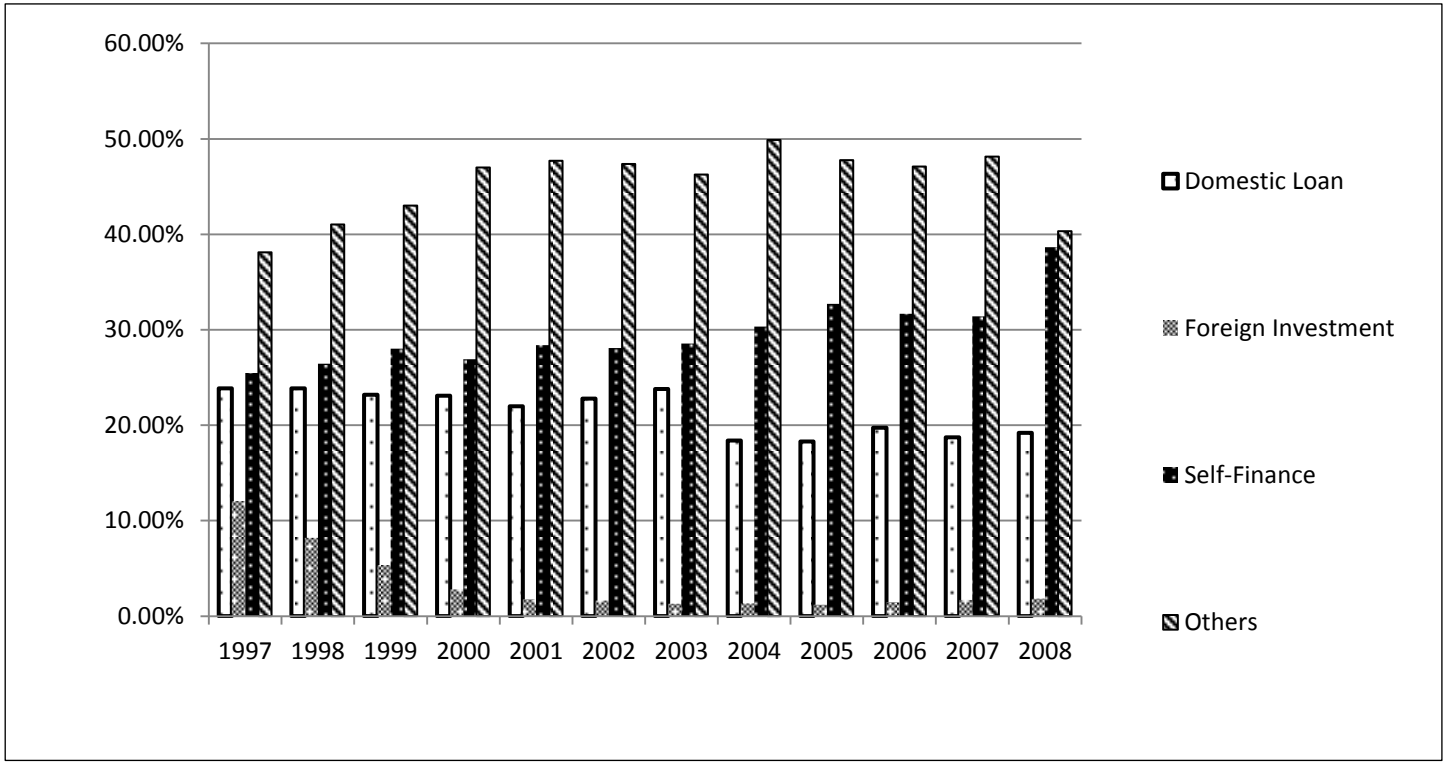


Table 1: Summary of selected studies written in Chinese

Author	Period	Estimation method	Impacts of housing wealth/Price on consumption
Zhu and Li (2006)	2000,Q1-2005,Q1	OLS	The elasticity of consumer spending with respect to housing price is -0.3534
Li and Li (2006)	1990-2003	ECM	The long-run marginal propensity to consume (MPC) from housing price is 0.1019, compared to -0.224 in the short-run
Li and Tong (2007)	Feb,2001-Oct,2006	ECM	Out of the five cities selected, four of them witnessed the positive impact of housing price on consumption and compared to one city with the negative effect, however, the short-run effect amongst the cities different from each other.
Song (2007)	1998,Q3-2006,Q4	ECM, Granger causality test	Housing price affect consumer spending positively and Granger cause it in both the short run and the long run.
Wei (2007)	Feb,2002-May,2005	ECM	1% change in housing prices led to the changes in consumption ranging from 12% to 18% in the same direction, compared to the smaller elasticity 0.08 to 0.09 corresponding to the short-run fluctuations.
Zhang (2007)	1987-2005	ECM, Granger causality test	Housing price brings negative effect on consumption both in short-run and long-run, and the elasticity are -0.226 and -0.443 respectively.
Zhao, et al. (2007)	Jan,1991-Jan,2005	ECM	The MPC from housing prices is 0.22 over the full sample period and 0.91 during the subsample(Jan,1996-Jan,2005)
Lai and Bai (2008)	Jan,1997-Oct,2007	ECM, Granger causality test	The housing wealth can positively affect consumption in the long-run, but short-run effect is negative, with the elasticity of 0.4043 and -0.0188 respectively.

Table 2: Correlation Analysis

	Housing price	Consumption		Real Housing price	Real consumption		**Log Real Housing price**	**Log Real consumption**
Consumption	0.2844		Real consumption	0.2774		**Log Real Consumption**	**0.5247**	
Income	0.5791	0.4772	Real Income	0.5667	0.4696	**Log Real Income**	**0.6522**	**0.7099**

Table 3: Panel Unit Root Test.
(IPS approach)

City	Income		Housing price		Consumption	
	level	1st diff	level	1st diff	level	1st diff
	P-Value		P-Value		P-Value	
Im, Pesaran and Shin W-stat	0.2651	0.0000	0.9970	0.0000	0.9914	0.0000
Beijing	0.8568	0.1318	0.7382	0.0014	0.9108	0.0000
Shanghai	0.1460	0.1045	0.6397	0.0000	0.8757	0.0136
Tianjin	0.9273	0.0000	0.9591	0.0052	0.9905	0.0000
Shenzhen	0.1902	0.2568	0.3806	0.0010	0.3643	0.0000
Suzhou	0.6291	0.3529	0.5133	0.0000	0.8162	0.0013
Guangzhou	0.9905	0.0000	0.7779	0.0001	0.8005	0.0000
Hangzhou	0.8454	0.1780	0.7379	0.0025	0.8182	0.0000
Wuhan	0.7524	0.0000	0.4686	0.0006	0.8949	0.0000
Dalian	0.6977	0.0031	0.9997	0.0000	0.9514	0.3916
Nanjing	0.7175	0.2157	0.8927	0.0006	0.6220	0.0003
Wuxi	0.0144	0.0000	0.8563	0.0038	0.0936	0.0188
Xiamen	0.7864	0.0000	0.0565	0.0072	0.4060	0.0000
Xi'an	0.6270	0.0000	0.9918	0.1227	0.8373	0.0082
Changsha	0.2284	0.0000	0.1083	0.1550	0.7489	0.0650
Shenyang	0.4357	0.0000	1.0000	0.9564	0.7006	0.0000
Zhengzhou	0.8124	0.0000	0.8887	0.0023	0.9996	0.0001
Dongguan	0.0025	0.0001	0.1505	0.2145	0.5427	0.0039
Fuzhou	0.5905	0.0000	0.6250	0.0051	0.5395	0.0000
Foshan	0.0648	0.0009	0.4615	0.0006	0.0319	0.0227
Ningbo	0.6058	0.0002	0.7031	0.0225	0.9478	0.0027
Nanchang	0.8676	0.0416	0.9449	0.0014	0.8228	0.0001
Hefei	0.0688	0.1578	0.3361	0.0512	0.6381	0.0000
Tangshan	0.4808	0.0000	0.0233	0.0154	0.1385	0.0011

Individual intercept is included.
All variables are log real terms.

Table 4: Residual based Cointegration test.
(Pedroni approach)

Alternative hypothesis: common AR coefs. (within-dimension)				
			Weighted	
	Statistic	Prob.	Statistic	Prob.
Panel v-Statistic	-4.049131	1.0000	-4.292143	1.0000
Panel rho-Statistic	0.472497	0.6817	-2.192720	0.0142
Panel PP-Statistic	-17.33371	0.0000	-23.98255	0.0000
Panel ADF-Statistic	-18.44202	0.0000	-17.01488	0.0000

Alternative hypothesis: individual AR coefs. (between-dimension)		
	Statistic	Prob.
Group rho-Statistic	0.509345	0.6947
Group PP-Statistic	-27.78154	0.0000
Group ADF-Statistic	-15.94205	0.0000

1. Automatic lag length selection based on SIC with lags from 1 to 4.
2. Individual intercept and individual trend are allowed.

According to Pedroni (1999), the first statistics of the simple panel cointegration statistics (within dimension) is a type of non-parametric variance ratio statistic. The second is a panel version of a non-parametric statistic that is analogous to the familiar Phillips and Perron rho-statistic. The third statistic is also non-parametric and is analogous to the Phillips and Perron t-statistic. Finally, the fourth of the simple panel cointegration statistics is a parametric statistic which is analogous to the familiar augmented Dickey-Fuller (ADF) t-statistic. The other three panel cointegration statistics are based on a group mean approach (between-dimension). The first of these is analogous to the Phillips and Perron rho-statistic, and the last two are analogous to the Phillips and Perron t-statistic and the augmented Dickey-Fuller (ADF) t-statistic respectively

Table 5: Long run equilibrium

VARIABLES	*cmpt*	*cmpt*	*cmpt*	*cmpt*	*cmpt*	*cmpt*	*cmpt*	*cmpt*	*cmpt*	*cmpt*	*cmpt*	*cmpt*
	2nd month *hp*				1st month *hp*				3rd month *hp*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
hp	**0.0881****	**0.2267*****	**0.0824****	**0.2182*****	**0.0807****	**0.2123*****	**0.0760****	**0.2052*****	**0.0820****	**0.2217*****	**0.0760****	**0.2126*****
	(0.0120)	(0.0000)	(0.0159)	(0.0000)	(0.0198)	(0.0000)	(0.0246)	(0.0000)	(0.0254)	(0.0000)	(0.0334)	(0.0000)
inc	**0.6653*****	**0.4103*****	**0.6817*****	**0.4329*****	**0.6733*****	**0.4180*****	**0.6893*****	**0.4405*****	**0.6713*****	**0.4147*****	**0.6887*****	**0.4385*****
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
gdpr	**-0.0718****	**0.0074**	**-0.0713****	**0.0139**	**-0.0783****	**0.0031**	**-0.0775****	**0.0097**	**-0.0755****	**0.0094**	**-0.0749****	**0.0163**
	(0.0438)	(0.8119)	(0.0438)	(0.6565)	(0.0284)	(0.9220)	(0.0290)	(0.7624)	(0.0354)	(0.7683)	(0.0357)	(0.6101)
constant	**1.6477*****	**2.7076*****	**1.7418*****	**2.6009*****	**1.7456*****	**2.7692*****	**1.7361*****	**2.6531*****	**1.6474*****	**2.7113*****	**1.7412*****	**2.5997*****
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Quarter Dummies	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
City Dummies	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	No	No
R-squared	0.494	0.398			0.491	0.391			0.492	0.394		

1. ***hp***-housing prices.
   inc- Income.
   cmpt-consumption.
   gdpr-growth rate of GDP
2. The dependent variable is log real consumption, and the independent variables are log real housing price, log real income and log real GDP growth rate as control variable. Quarter/city dummies are also included.
3. P-Value in parentheses.
4. ***, ** and * represents statistic significance at 1%, 5% and 10% respectively.

Table 6: Short-Run dynamics

VARIABLES	*d_cmpt*	*d_cmpt*	*d_cmpt*	*d_cmpt*	*d_cmpt*	*d_cmpt*
	2nd month ***hp***		1st month ***hp***		3rd month ***hp***	
	(1)	(2)	(3)	(4)	(5)	(6)
d_hp	**0.1192****	**0.2110*****	**0.0957***	**0.1772*****	**0.0791**	**0.1601*****
	(0.0160)	(0.0001)	(0.0551)	(0.0011)	(0.1300)	(0.0048)
d_hp_1	**0.0192**	**0.0027**	**-0.0009**	**-0.0263**	**0.0121**	**-0.0223**
	(0.6880)	(0.9574)	(0.9856)	(0.6224)	(0.8182)	(0.6944)
d_cmpt_1	**0.3000*****	**0.2327*****	**0.3021*****	**0.2397*****	**0.3015*****	**0.2436*****
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
d_inc	**0.4121*****	**0.2328*****	**0.4250*****	**0.2320*****	**0.4152*****	**0.2292*****
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
d_inc_1	**-0.3393*****	**-0.2854*****	**-0.3354*****	**-0.2912*****	**-0.3402*****	**-0.2933*****
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
d_gdpr	**-0.0867*****	**-0.0636****	**-0.0897*****	**-0.0646****	**-0.0867*****	**-0.0578****
	(0.0015)	(0.0191)	(0.0011)	(0.0182)	(0.0017)	(0.0350)
d_gdpr_1	**-0.0057**	**-0.0484***	**-0.0038**	**-0.0452***	**-0.0004**	**-0.0438***
	(0.8286)	(0.0573)	(0.8857)	(0.0806)	(0.9889)	(0.0915)
ect_1	**-1.4256*****	**-1.2149*****	**-1.4308*****	**-1.2193*****	**-1.4291*****	**-1.2242*****
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
constant	**0.1004*****	**0.0110***	**0.1390*****	**0.0114**	**0.1063*****	**0.0135****
	(0.0000)	(0.0995)	(0.0000)	(0.1010)	(0.0000)	(0.0498)
City Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Dummies	Yes	No	Yes	No	Yes	No
R-squared	0.6583	0.5990	0.6558	0.5905	0.6559	0.5930

1. ***hp***-housing prices. ***inc***- Income. ***cmpt***-consumption. ***gdpr***-growth rate of GDP ***ect*** -Error correction term, that is the residual from long-run equilibrium equation.
2. P-Value in parentheses.
3. The dependent variable is contemporaneous changes in consumption, and the independent variables are contemporaneous difference and one-quarter lagged changes in housing price, income and GDP respectively. All series are log real terms.
4. ***, ** and * represents statistic significance at 1%, 5% and 10% respectively.

Table 7: IV estimation for long-run equilibrium.

2-4 lagged consumption, lagged income and lagged housing prices as instruments.

VARIABLES	*cmpt*	*cmpt*	*cmpt*	*cmpt*	*cmpt*	*cmpt*
	(1)	(2)	(3)	(4)	(5)	(6)
hp	**0.2277*** **	**0.4286*** **	**0.3927*** **	**0.1967*** **	**0.4403*** **	**0.4081*** **
	(0.0012)	(0.0000)	(0.0000)	(0.0028)	(0.0000)	(0.0000)
inc	**0.4873*** **	**0.2140*** **	**0.2666*** **	**0.5474*** **	**0.2008*** **	**0.2497*** **
	(0.0000)	(0.0029)	(0.0002)	(0.0000)	(0.0061)	(0.0006)
gdpr	**-0.0538**	**-0.0542**	**-0.0374**	**-0.0521**	**-0.0585**	**-0.0430**
	(0.1584)	(0.1317)	(0.3036)	(0.1770)	(0.1079)	(0.2441)
constant	**2.0900*** **	**2.5996*** **	**2.4891*** **	**1.8714*** **	**2.6089*** **	**2.4973*** **
	(0.0001)	(0.0000)	(0.0000)	(0.0004)	(0.0000)	(0.0000)
Quarter dummies in Stage 1	Yes	Yes	Yes	Yes	No	No
Quarter dummies in Stage 2	Yes	No	No	Yes	No	No
City fixed effect	Yes	Yes	No	No	Yes	No

1. ***hp***-housing prices.
   inc- Income.
   cmpt-consumption.
   gdpr-growth rate of GDP
2. P-Value in parentheses
3. The dependent variable is log real consumption, and the independent variables are log real housing price, log real income and log real GDP growth rate as control variable. Quarter/city dummies are also included.
4. ***, ** and * represents statistic significance at 1%, 5% and 10% respectively.

Table 8: Hausman test comparing 2SLS and OLS: Long-run equilibrium.

VARIABLES	Coefficients (b) 2SLS	(B) OLS	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
hp	0.115343	0.088109	0.027234	.
inc	0.607798	0.665291	-0.05749	.
gdpr	-0.05199	-0.07182	0.019824	.
constant	2.065588	1.647742	0.417846	.

b = consistent under Ho and Ha; obtained from 2SLS

B = inconsistent under Ha, efficient under Ho; obtained from OLS

Test: Ho: difference in coefficients not systematic

chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B) =12506.72

Prob>chi2=0.0000

(V_b-V_B is not positive definite)

This is hausman test comparing two selected equations: one is from IV estimation where both city fixed effect and quarter dummies are included; the other is from the short-run dynamic equation, also with both city fixed effect and quarter dummies.

The null hypothesis that OLS estimator is consistent is therefore rejected, which confirms that IV estimation by 2SLS is preferable to OLS estimation.

Table 9: IV estimation for short-run dynamics.

2-4 lagged changes in consumption, lagged changes in income and lagged changes in housing prices as instruments.

VARIABLES	*d_cmpt*	*d_cmpt*	*d_cmpt*	*d_cmpt*	*d_cmpt*	*d_cmpt*
	(1)	(2)	(3)	(4)	(5)	(6)
d_hp	**0.4949*** **	**0.4594*** **	**1.3700*** **	**1.4973*** **	**0.5453*** **	**1.7570*** **
	(0.0069)	(0.0037)	(0.0000)	(0.0010)	(0.0024)	(0.0001)
d_hp_1	**0.0961**	**0.1192***	**0.3749*** **	**0.4118*** **	**0.1394** **	**0.4596*** **
	(0.1699)	(0.0631)	(0.0018)	(0.0053)	(0.0420)	(0.0021)
d_inc	**0.2225** **	**0.2329*** **	**0.1569**	**0.0578**	**0.2416*** **	**0.1907**
	(0.0174)	(0.0001)	(0.1519)	(0.7581)	(0.0001)	(0.1435)
d_lrinc_1	**-0.1252**	**0.2261*** **	**-0.1934** **	**-0.2213**	**0.2242*** **	**-0.1876***
	(0.1235)	(0.0000)	(0.0342)	(0.1713)	(0.0000)	(0.0813)
d_gdpr	**-0.0735** **	**0.0892*** **	**0.1679*** **	**-0.1611** **	**0.0954*** **	**0.1977*** **
	(0.0255)	(0.0049)	(0.0048)	(0.0144)	(0.0042)	(0.0062)
d_gdpr_1	**-0.0609** **	**-0.0679** **	**-0.0838**	**-0.0789**	**-0.0726** **	**-0.1057***
	(0.0398)	(0.0162)	(0.1068)	(0.1706)	(0.0138)	(0.0908)
ect_1	**0.9586*** **	**0.9154*** **	**-0.1396** **	**-0.1473** **	**0.9152*** **	**-0.1393** **
	(0.0000)	(0.0000)	(0.0140)	(0.0257)	(0.0000)	(0.0373)
Constant	**0.0278***	**0.0003**	**-0.0409** **	**-0.0456**	**-0.0036**	**-0.0579** **
	(0.0583)	(0.9798)	(0.0362)	(0.1174)	(0.7369)	(0.0202)
Quarter dummies in Stage 1	Yes	Yes	Yes	Yes	No	No
Quarter dummies in Stage 2	Yes	No	No	Yes	No	No
City fixed effect	Yes	Yes	No	No	Yes	No

1. ***hp***-housing prices; ***inc***- Income ***cmpt***-consumption ***gdpr***-growth rate of GDP.

2. P-Value in parentheses.

3. The dependent variable is contemporaneous changes in consumption, and the independent variables are contemporaneous difference and one-quarter lagged changes in housing price, income and GDP growth rate respectively. In this case, only the results estimated from the 2nd month housing price are reported. All series are log real terms.

4. Instruments are 2-4 lagged changes in consumption, lagged changes in income and lagged changes in housing prices as instruments.

5. ***, ** and * represents statistic significance at 1%, 5% and 10% respectively.

Table 10: Hausman test comparing 2SLS and OLS: Short-run dynamics.

	Coefficients			
VARIABLES	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	2SLS	OLS	Difference	S.E.
d_hp	0.459377	0.211037	0.24834	0.0393882
d_inc	0.232901	0.232778	0.000122	.
d_hp _1	0.119234	0.002735	0.116499	.
d_inc _1	-0.22606	-0.28545	0.059387	.
d_gdpr	-0.08922	-0.06359	-0.02563	.
d_gdpr _1	-0.06788	-0.0484	-0.01948	.
ect_1	-0.91545	-1.21487	0.299423	.
constant	0.00025	0.011043	-0.01079	.

b = consistent under Ho and Ha; obtained from 2SLS

B = inconsistent under Ha, efficient under Ho; obtained from OLS

Test: Test: Ho: difference in coefficients not systematic

chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)=28.36

Prob>chi2 = 0.0000

Prob>chi2 = 0.0000

This is hausman test comparing two selected equations: one is from IV estimation where only city fixed effect is included; the other is from the short-run dynamic equation with only city fixed effect is included.

The null hypothesis that OLS estimator is consistent is therefore rejected, which confirms that IV estimation by 2SLS is preferable to OLS estimation.

Table 11: Robust test summary.

VARIABL	Instruments	Lags	*d_cmpt*	*d_cmpt*	*d_cmpt*	*d_cmpt*	*d_cmpt*	*d_cmpt*
			City & Quarter Dummies in Stage 1 and Stage 2	City & Quarter Dummies in Stage 1	Quarter Dummies in Stage 1	Quarter Dummies in Stage 1 and Stage 2	City Dummies	No Dummies
			(1)	(2)	(3)	(4)	(5)	(6)
d_hp	**Lagged changes in income**	**2^{nd} -4^{th}**	**0.4405****	**0.6255*****	**0.8690*****	**0.5443**	**0.7919*****	**0.9379****
			(0.0396)	(0.0012)	(0.0039)	(0.1363)	(0.0015)	(0.0166)
d_hp	**Lagged changes in consumption**	**2^{nd} -4^{th}**	**-1.6897**	**0.4266****	**1.7918*****	**0.7840**	**0.4259****	**1.8885*****
			(0.4407)	(0.0123)	(0.0002)	(0.5437)	(0.0240)	(0.0002)
d_hp	**Both**	**2^{nd} -4^{th}**	**0.4949*****	**0.4594*****	**1.3700*****	**1.4973*****	**0.5453*****	**1.7570*****
			(0.0069)	(0.0037)	(0.0000)	(0.0010)	(0.0024)	(0.0001)
d_hp	**Lagged changes in income**	**2^{nd} -6^{th}**	**0.3162****	**0.3152****	**0.2741**	**-0.0133**	**0.3055****	**0.1398**
			(0.0189)	(0.0106)	(0.1290)	(0.9494)	(0.0242)	(0.5052)
d_hp	**Lagged changes in consumption**	**2^{nd} -6^{th}**	**0.1327**	**0.2371***	**0.6299*****	**0.1705**	**0.2464***	**0.6813*****
			(0.4621)	(0.0514)	(0.0013)	(0.6429)	(0.0571)	(0.0012)
d_hp	**Both**	**2^{nd} -6^{th}**	**0.2287***	**0.2311****	**0.5007*****	**0.3490***	**0.2347***	**0.1071**
			(0.0596)	(0.0419)	(0.0033)	(0.0602)	(0.0537)	(0.5757)

1. ***hp***-housing prices.
   cmpt-consumption.
2. ***, ** and * represents statistic significance at 1%, 5% and 10% respectively.
3. P-Value in parentheses
4. In this case, only the results estimated from the 2^{nd} month housing price are reported.

This is a summary the estimated housing wealth effect for the combinations of city and quarter fixed-effect control, instrument lags (2-4 or 2-6), and the instruments used in addition to lagged housing prices (income, consumption, or both). In particular, quarter dummies are taken account in stage 1 or stage 2 estimation during the 2SLS regression process.

Appendix.

Table 12: Data availability and statistic description.

City	Variable	Obs	Period	Max	Min	Mean
Beijing	Housing Price (RMB/Square meter)	24	2005 Q1-2010 Q4	20552	6817	11464.4
	Consumption (RMB)	24	2005 Q1-2010 Q4	5657	3120	4263
	Income (RMB)	24	2005 Q1-2010 Q4	7669	4281	5840
	GDP (RMB bn)	24	2005 Q1-2010 Q4	4024	1485	2489
Shanghai	Housing Price (RMB/Square meter)	24	2005 Q1-2010 Q4	14888	6019	9653.4
	Consumption (RMB)	24	2005 Q1-2010 Q4	6380	3177	4558
	Income (RMB)	24	2005 Q1-2010 Q4	8925	4356	6262
	GDP (RMB bn)	24	2005 Q1-2010 Q4	4762	1802	3206
Tianjin	Housing Price (RMB/Square meter)	24	2005 Q1-2010 Q4	9587	3566	6378.03
	Consumption (RMB)	24	2005 Q1-2010 Q4	4600	2260	3209
	Income (RMB)	24	2005 Q1-2010 Q4	7278	2855	4517
	GDP (RMB bn)	24	2005 Q1-2010 Q4	2660	705	1500
Shenzhen	Housing Price (RMB/Square meter)	24	2005 Q1-2010 Q4	23718	6171	13203.4
	Consumption (RMB)	24	2005 Q1-2010 Q4	6846	4223	5568
	Income (RMB)	24	2005 Q1-2010 Q4	9734	6308	7609
	GDP (RMB bn)	24	2005 Q1-2010 Q4	2789	916	1786
Suzhou	Housing Price (RMB/Square meter)	22	2005 Q3-2010 Q4	11499	4742	6863.55
	Consumption (RMB)	24	2005 Q1-2010 Q4	4821	2562	3627
	Income (RMB)	24	2005 Q1-2010 Q4	8612	3614	5645
	GDP (RMB bn)	24	2005 Q1-2010 Q4	2789	916	1786
Guangzhou	Housing Price (RMB/Square meter)	20	2006 Q1-2010 Q4	15072	5564	9255.38
	Consumption (RMB)	24	2005 Q1-2010 Q4	6567	3488	4897
	Income (RMB)	24	2005 Q1-2010 Q4	8951	4264	6008
	GDP (RMB bn)	24	2005 Q1-2010 Q4	2950	1023	1924
Hangzhou	Housing Price (RMB/Square meter)	20	2006 Q1-2010 Q4	28253	6811	14396.5
	Consumption (RMB)	24	2005 Q1-2010 Q4	5388	3092	4097
	Income (RMB)	24	2005 Q1-2010 Q4	10007	3665	5763
	GDP (RMB bn)	24	2005 Q1-2010 Q4	1900	561	1095
Wuhan	Housing Price (RMB/Square meter)	20	2006 Q1-2010 Q4	6664	3648	5015.05
	Consumption (RMB)	24	2005 Q1-2010 Q4	3879	1921	2777
	Income (RMB)	24	2005 Q1-2010 Q4	6066	2609	3895
	GDP (RMB bn)	24	2005 Q1-2010 Q4	1534	316	917

Table 12: Data availability and statistic description. (Cont'd)

City	Variable	Obs	Period	Max	Min	Mean
Dalian	Housing Price (RMB/Square meter)	20	2006 Q1-2010 Q4	13040	4879	7919.83
	Consumption (RMB)	24	2005 Q1-2010 Q4	4753	2345	3278
	Income (RMB)	24	2005 Q1-2010 Q4	5520	2792	4094
	GDP (RMB bn)	24	2005 Q1-2010 Q4	1481	412	887
Nanjing	Housing Price (RMB/Square meter)	20	2006 Q1-2010 Q4	12185	4097	6871.69
	Consumption (RMB)	24	2005 Q1-2010 Q4	4760	2500	3577
	Income (RMB)	24	2005 Q1-2010 Q4	8476	3402	5407
	GDP (RMB bn)	24	2005 Q1-2010 Q4	1383	500	895
Wuxi	Housing Price (RMB/Square meter)	19	2006 Q1-2010 Q4	9187	3926	5870
	Consumption (RMB)	16	2007 Q1-2010 Q4	5831	2637	3582
	Income (RMB)	16	2007 Q1-2010 Q4	8996	4707	6016
	GDP (RMB bn)	24	2005 Q1-2010 Q4	1545	601	1124
Xiamen	Housing Price (RMB/Square meter)	16	2007 Q1-2010 Q4	12247	6172	9930.09
	Consumption (RMB)	24	2005 Q1-2010 Q4	5515	2609	4061
	Income (RMB)	24	2005 Q1-2010 Q4	8551	3754	5656
	GDP (RMB bn)	24	2005 Q1-2010 Q4	612	233	367
Xi'an	Housing Price (RMB/Square meter)	16	2007 Q1-2010 Q4	6725	3408	4635.81
	Consumption (RMB)	24	2005 Q1-2010 Q4	3840	1744	2728
	Income (RMB)	24	2005 Q1-2010 Q4	5108	2178	3466
	GDP (RMB bn)	24	2005 Q1-2010 Q4	1132	254	503
Changsha	Housing Price (RMB/Square meter)	16	2007 Q1-2010 Q4	5200	2822	3967.52
	Consumption (RMB)	24	2005 Q1-2010 Q4	4345	2190	3147
	Income (RMB)	24	2005 Q1-2010 Q4	6862	2682	4295
	GDP (RMB bn)	24	2005 Q1-2010 Q4	1440	282	700
Shenyang	Housing Price (RMB/Square meter)	16	2007 Q1-2010 Q4	5588	3065	3879.27
	Consumption (RMB)	24	2005 Q1-2010 Q4	4638	1799	3147
	Income (RMB)	24	2005 Q1-2010 Q4	5440	2370	3872
	GDP (RMB bn)	24	2005 Q1-2010 Q4	1370	380	876
Zhengzhou	Housing Price (RMB/Square meter)	16	2007 Q1-2010 Q4	6332	2958	4411.96
	Consumption (RMB)	24	2005 Q1-2010 Q4	3272	1661	2338
	Income (RMB)	24	2005 Q1-2010 Q4	5063	2539	3746
	GDP (RMB bn)	20	2006 Q1-2010 Q4	1247	405	736

Table 12: Data availability and statistic description. (Cont'd)

City	Variable	Obs	Sample Period	Max	Min	Mean
Dongguan	Housing Price (RMB/Square meter)	14	2007 Q3-2010 Q4	8801	5363	6913.48
	Consumption (RMB)	16	2007 Q1-2010 Q4	7194	5051	5922
	Income (RMB)	16	2007 Q1-2010 Q4	12053	5737	7918
	GDP (RMB bn)	16	2007 Q1-2010 Q4	1165	665	929
Fuzhou	Housing Price (RMB/Square meter)	14	2007 Q3-2010 Q4	11320	3889	7422.95
	Consumption (RMB)	24	2005 Q1-2010 Q4	4265	1959	3104
	Income (RMB)	24	2005 Q1-2010 Q4	6641	2912	4404
	GDP (RMB bn)	22	2005 Q3-2010 Q4	1145	306	590
Foshan	Housing Price (RMB/Square meter)	14	2007 Q3-2010 Q4	8076	4776	6151.9
	Consumption (RMB)	12	2008 Q1-2010 Q4	21995	4765	12273
	Income (RMB)	12	2008 Q1-2010 Q4	7835	5117	6193
	GDP (RMB bn)	24	2005 Q1-2010 Q4	1546	423	984
Ningbo	Housing Price (RMB/Square meter)	12	2008 Q1-2010 Q4	19106	6863	11695.9
	Consumption (RMB)	24	2005 Q1-2010 Q4	5136	2758	3848
	Income (RMB)	24	2005 Q1-2010 Q4	9833	3861	5926
	GDP (RMB bn)	24	2005 Q1-2010 Q4	1516	512	919
Nanchang	Housing Price (RMB/Square meter)	12	2008 Q1-2010 Q4	8020	3516	5252.11
	Consumption (RMB)	24	2005 Q1-2010 Q4	3814	1603	2606
	Income (RMB)	24	2005 Q1-2010 Q4	4980	2277	3527
	GDP (RMB bn)	16	2007 Q1-2010 Q4	648	241	440
Hefei	Housing Price (RMB/Square meter)	12	2008 Q1-2010 Q4	6807	3557	4915.11
	Consumption (RMB)	24	2005 Q1-2010 Q4	3791	1671	2665
	Income (RMB)	24	2005 Q1-2010 Q4	5393	2261	3580
	GDP (RMB bn)	16	2007 Q1-2010 Q4	892	241	488
Tangshan	Housing Price (RMB/Square meter)	13	2007 Q4-2010 Q4	8748	3589	5642.86
	Consumption (RMB)	12	2008 Q1-2010 Q4	3699	2756	3209
	Income (RMB)	12	2008 Q1-2010 Q4	5221	3862	4499
	GDP (RMB bn)	9	2008 Q4-2010 Q4	3560	745	1293
Total	**Housing Price (RMB/Square meter)**	**408**		**28253**	**2822**	**7752.5**
	Consumption (RMB)	**512**		**21995**	**1603**	**3824**
	Income (RMB)	**512**		**12053**	**2178**	**5069**
	GDP (RMB bn)	**507**		**4762**	**233**	**1176**