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ANALYSIS OF THE IMPACT OF HOUSING PRICES ON DIFFERENT TYPES OF FAMILIES – EVIDENCE FROM CHINA

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Abstract. *House is a unique product with consumption, investment and welfare attributes. However, there are contradictions among these attributes. Each attribute corresponds to a different type of family. We divide them into three categories: consumers, investors and tenants. These three families react differently to changes in house prices. The same direction of housing prices has different effects on them. This is why Chinese government introduces a number of regulatory policies but with little success. To further illustrate this issue, we use utility function, investment function and consumption function to demonstrate the effect of price volatility on the behavior of consumers, investors and tenants. In this system, rising prices will increase investors' welfare and stimulate investment; the consumption of consumers and housing prices is into an inverted U-shaped curve; the consumption of tenants is inversely proportional to prices. Finally, we use panel data of 31 provinces (municipalities) in China to test our view and found that there are different effects of housing prices on three different types of households during the same period.*

Keywords: Housing prices, Different types of families, House attributes, Panel data

1. **Introduction.** House is a special product that is different from any other commodity. It can be used as a consumer product to live and operate, and can also be used as an investment product to invest in and be value-added, and can also be used as a social welfare tool to enhance people's livelihood. This particularity of housing comes from the six basic functions of housing[1]: residential functions, asylum functions, life functions, social functions, wealth reserve functions and business support functions. We classify these six basic functions from the perspective of economics: consumption, investment and social welfare. Consumption refers to meeting people's production and living needs, so it corresponds to residential functions, shelter functions, life functions and social functions; investment refers to the realization of wealth enhancement of housing, corresponding to the function of wealth reserve and the auxiliary function of operation; social welfare refers to housing as a function of housing and shelter for human survival. This is the most basic condition for the existence of social welfare. These three attributes of housing correspond to three different types of demand groups. Because of the different housing needs of the three groups, the impact of housing price changes on the three groups is also different. Three groups respond differently to changes in housing prices.

Current research focuses on the wealth effect of housing and the impact of housing prices on income gaps and investment behaviors of different income groups. For example, Quigley [1] believes that rising housing prices have a strong wealth effect. However, some scholars believe that the rise in housing prices is nothing but a transfer of wealth. Representative studies include Chen and Qiu [2], Li and Li [3], etc. There are also studies

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[1]See "Universal Declaration of Human Rights" terms of section 25.

that rising housing prices do not lead to inequality in family property, such as Díaz et al. [4]. Research on whether housing price changes have a wealth effect on households and how it affects family behavior are also gradually deepening, such as Kartashova and Tomlin [5], Burrows [6], Du and Luo [7] and Wang et al. [8], but their researches have reached different conclusions. There are also some studies directly studying housing prices and household consumption behavior, such as Yan et al. [9], Wan et al. [10] and Zhou and Zhou [11].

Existing research is mainly based on the physical form of housing, considering housing as durable consumer goods or as an investment. Few studies on housing wealth and family behavior have considered housing as neither a durable consumer product nor a simple investment but the unity of the two and also a social welfare product. Therefore, we have fully considered the three basic attributes of housing and discussed the response of three types of households corresponding to the three attributes in the change of housing prices, and the changes in welfare of three types of households. Compared with previous studies, it can more accurately describe the wealth effect and income redistribution effect of housing prices. We use the panel data of provinces in China. The large housing price gap in these 31 provinces guarantees effective distribution of samples.

So the organization of this paper is shown as follows. In the second section, we use classical economics theory to study and analyze the impact of housing price changes on the consumption behavior and welfare of the three types of households. In the third section, the state space model and the panel data of 31 provinces in China are used to test the conclusions of the second section; and dynamically describe the impact of housing price changes on different types of households. The last part is the conclusion of the article.

2. The Impact of Housing Price Changes on Three Types of Households.

2.1. How rising prices affect household welfare[2]. Let us consider two types of households; one has owned houses and already met the basic living needs, whose housing demands were for the purpose of improving living environment or simply investing[3]; the other is tenants without shelter. Improvement consumers and investors regard their houses or real estates as assets, who can get the entire utility of owning houses and the "wealth added" of rising prices. They could also be called non-welfare demand households. Tenants have to choose from renting without savings or saving for buying house in the future, and both are for living. So tenants can also be called welfare demand households. We assume that other forms of family assets are stocks, and labor productivity is constant. Here the lower case letters represent the actual value of the corresponding variables. The welfare demand households have to pay the rent re_t in each period. Let $re_t = \eta p_t$, where p_t stand for the prices and $\eta > 0$ means that rents and prices are proportional. Welfare demand households need to save more s_t^u in each period as long as the housing prices p_t rise, so $s_t^u = \kappa p_t$, $\kappa > 0$. The non-welfare demand households could have more mortgage lending or sell their real estates at a high price, which means a value of housing assets $h_t = \psi p_t$, $\psi > 0$. The goals of two types of households are all selecting the optimal consumption, investment and saving scales in each period to maximize total utility. We focus on the responses of household wealth and utility to prices but not on optimal selection; therefore, we use static analysis here. In period t, the household utility is:

$$u(C(t)) = \frac{C(t)^{1-\theta}}{1-\theta} \tag{1}$$

[2]Since the analysis processes are similar, we only analyze the situation when housing prices rise.

[3]They are improvement consumers and investors.

Here we use constant relative risk aversion utility function to describe one-period utility. The constraint of non-welfare demand households is

$$y_t^h = c_t^h + i_t^h \tag{2}$$

where i_t^h is the willing stock investment and c_t^h is the consumption of non-welfare demand households. Here $y_t^h = L^\nu h_t^\beta w^\gamma$ stand for incomes of non-welfare demand households, where L is the constant labor provided by households and w is the constant stock bonus.

The welfare demand households must save s_t^u for buying future house and pay the rent re_t. So the constraint of welfare demand households is

$$y_t^u = s_t^u + re_t + i_t^u + c_t^u \tag{3}$$

where i_t^u is the willing stock investment and c_t^u is the consumption of welfare demand households. Let $y_t^u = L^\phi w^\varpi$ be the incomes of welfare demand households.

We can get $c_t^h = y_t^h - i_t^h$ from Equation (2). And substitute this expression in Equation (1) and expand y_t^h, then we can obtain

$$u_t^h = \frac{\left[L^\nu \left(\psi p_t\right)^\beta w^\gamma - i_t^h\right]^{1-\theta}}{1-\theta} \tag{4}$$

This is the utility function of non-welfare demand households. Then we combine Equations (3) and (1) to get the utility function of welfare demand households

$$u_t^u = \frac{\left(L^\phi w^\varpi - \kappa p_t - \eta p_t - i_t^u\right)^{1-\theta}}{1-\theta} \tag{5}$$

Here u_t^h and u_t^u represent the utility of this two groups respectively. Differentiating Equations (4) and (5) with respect to p_t, we derive that

$$\begin{aligned} &\left[L^\nu \left(\psi p_t\right)^\beta w^\gamma - i_t^h\right]^{-\theta} \cdot L^\nu w^\gamma \psi^\beta \beta p_t^{\beta-1} > 0 \\ &-\left(L^\phi w^\varpi - \kappa p_t - \eta p_t - i_t^u\right)^{-\theta} \cdot (\kappa + \eta) < 0 \end{aligned} \tag{6}$$

Equation (6) states that rising prices lead to a welfare improvement for non-welfare demand households, but a welfare loss for welfare demand households. One keeps increasing and the other declining, which will seemingly widen the gap unlimitedly.

2.2. **The impact of price changes on the behaviors of three groups.** We first observe the effect of rising prices on investors. In addition to residential function, houses can also be used to invest or hedge inflation. There are two types of returns on housing investments, one is the rental and the other is capital gains. Here we treat house as an interest-bearing asset and only consider its profitability. The lower case letters still represent the actual value of corresponding variables except for interest rate r. From investor's point of view, they spent i_t in period t to buy i_t/p_t units of houses at price p_t, and can get the rental income $(re_t \cdot i_t)/p_t$ by renting out houses or capital gains $(p_{t+1} \cdot i_t)/p_t$ by selling them in period $t+1$. The expected total profit in period $t+1$ is $E_t\left[\frac{1}{(1+r)} \times \frac{(re_{t+1}+p_{t+1})i_t}{p_t}\right]$. Assuming that households are optimum programming, therefore changes in consumption structure will not change the expected utility and the costs should be equal to the expected total profit. That is

$$dc_t = E_t\left[\frac{1}{(1+r)} \times \frac{\left(re_{t+1} + p_{t+1}\right) i_t}{p_t}\right] \tag{7}$$

Both sides reduce i_t and are multiplied by p_t, it becomes

$$p_t = E_t\left(\frac{re_{t+1} + p_{t+1}}{1+r}\right) \tag{8}$$

Equation (8) stands for the first-order conditions of household's optimum programming. A housing market without bubbles should meet

$$\lim_{i\to\infty} E_t\left[\frac{p_{t+i}}{(1+r)^i}\right] = 0 \tag{9}$$

Using iteration theorem, we can turn Equation (8) into

$$p_t = E_t\left[\frac{re_{t+1}}{(1+r)} + \frac{re_{t+2}}{(1+r)^2} + \cdots + \frac{re_{t+i}}{(1+r)^i}\right] + E_t\left[\frac{p_{t+i}}{(1+r)^i}\right] \tag{10}$$

Then we substitute Equation (8) in Equation (10) and obtain

$$p_t = \sum_{i=1}^{\infty} E_t\left[\frac{re_{t+i}}{(1+r)^i}\right] \tag{11}$$

Equation (11) states that housing price should equal the expected discounted value of future rents under no bubble assumption, and also implies that this should be the base price of houses. If we plus a deterministic bubble b on the base price, it becomes

$$p_t = \sum_{i=0}^{\infty} E_t\left[\frac{re_{t+i}}{(1+r)^i}\right] + (1+r)^t b \tag{12}$$

Because Equation (12) is applicable in each period, we can change it into

$$p_{t+1} = \sum_{i=1}^{\infty} E_{t+1}\left[\frac{re_{t+1+i}}{(1+r)^i}\right] + (1+r)^{t+1} b \tag{13}$$

Let us divide both sides of Equation (13) by $(1+r)$, then use iteration theorem and obtain

$$p_t = E_t\left(\frac{re_{t+1} + p_{t+1}}{1+r}\right) = \sum_{i=0}^{\infty} E_t\left[\frac{re_{t+i}}{(1+r)^i}\right] \tag{14}$$

It can be seen that Equations (14) and (11) are the same, which shows that the prices still meet the first-order conditions of household's optimum programming when there is a bubble in it. As long as there is an expectation of continued rising prices in the market, the household is willing to pay more than the discounted value of future cash flows to buy houses. That is to say, household will reduce consumption or other investments to invest more in real estates at this time.

Now we observe the effect of rising prices on the behaviors of improvement consumers. Assuming that improvement consumers have already owned houses and their housing demands were for the purpose of improving living conditions not for investment. And, their houses always are used as book assets that could be rented or sold to increase family income. Let C_t^g and C_t^{hh} be the consumption and housing costs of improvement consumers. Family income of each period is Y_t, and their marginal propensity to consume is λ_t^h. The consumption of improvement consumers can be expressed as:

$$C_t^g = \left(Y_t + \alpha P_t - C_t^{hh}\right)\lambda_t^h \tag{15}$$

where $0 < \alpha < 1$ is the proportion of capital appreciation of the properties changing into family incomes. For simplicity, we assume that $C_t^{hh} = \tau_1 \nu_t P_t$, where τ_1 is the parameter denoting the willingness to buy, $\nu_t = P_t/Y_t$ denotes the price-to-income ratio. So Equation (15) can be written as

$$C_t^g = Y_t\lambda_t^h + \alpha\lambda_t^h P_t - \lambda_t^h \tau_1 \frac{P_t^2}{Y_t} \tag{16}$$

From Equation (16) we can see the consumption of improvement consumers and housing prices are into an inverted U-shaped curve, which implies that rising prices could boost consumption at the beginning, but will reduce consumption after prices have exceeded

$P_t = \alpha Y_t/2\tau_1$. That is, improvement consumers cannot afford new houses without burden when prices are higher than $P_t = \alpha Y_t/2\tau_1$, who can only rely on reducing consumption to pay for that. This transition process proves that the needs of both improvement consumers and investors can be met before the prices rise to $P_t = \alpha Y_t/2\tau_1$. However, the utility of improvement consumers will decline after prices have exceeded that inflection point. These two groups have contradictions about the prices from now on. Therefore, we use one solid line to represent this conditional synergy in the impossible triangle.

Finally, we observe the effect of rising prices on tenants. Assuming that tenants are low-income families and they only want a house to live. We define C_t^n and C_t^{uh} as the consumption and housing costs of tenants. So we get $C_t^{uh} = \tau_2 \nu_t P_t$, where τ_2 is the parameter denoting the willingness to buy a house. The consumption of tenants can be written as

$$C_t^u = \left(Y_t - C_t^n - C_t^{uh}\right) \lambda_t^u \tag{17}$$

where λ_t^u is the marginal propensity to consume of tenants. We can rewrite Equation (17) as

$$C_t^g = Y_t \lambda_t^u - C_t^n \lambda_t^u - \lambda_t^u \tau_2 \frac{P_t^2}{Y_t} \tag{18}$$

Equation (18) shows that the consumption of tenants and housing prices are into an inverted U-shaped curve too, but the vertex is $P_t = 0$ at this time. That is to say the consumption of tenants is inversely proportional to housing prices all the time, which means tenants have to reduce consumption as long as housing prices rise. Tenants have to bear all the costs caused by rising prices, but were unable to benefit from capital appreciation of the houses. And, tenants are mostly low-income families, who almost spend all of their money on consumption and housing. So rising housing prices will squeeze their consumption and significantly lower their utility. Thus, we can say that there is no common interests between tenants and investors, but there is benefit intersection between tenants and consumers.

3. **Further Evidence from Chinese Housing Market.** Here we use the panel data of 31 provinces (municipalities) in China to test the previous conclusions. First, the parameters and variables need to be specified according to Chinese statistical standard. The household income Y_t is per capita disposable income, the household consumption C_t is per capita consumption expenditure, the housing costs C_t^h is per capita housing expenditure, and we get the actual housing prices P_t from commercial sales dividing by sales of commercial area. We define investors as households who have owned commercial residential houses and other forms of real estates, improvement consumers as households who have owned commercial residential houses or purchased public-owned residential premises, and the tenants as households who had no house. Then we can get the income and consumption data of investors, improvement consumers and tenants by calculation. The variables range from the first quarter of 2006 to the first quarter of 2011. The data sources are China Economic Information Statistics Database, China Economic and Social Development Statistics Database, China Urban Statistical Yearbook, China Real Estate Statistical Yearbook.

We set the first quarter of 2006 as base period and deflate the Y_t, C_t, C_t^h and P_t by CPI, where Y_t, C_t, C_t^h and P_t are seasonally adjusted. Then a state space model can be constructed according to Equations (16) and (18):

Signal equation: $C_t = sv1_t \times Y_t + sv2_t \times P_t + sv3_t \times C_t^h + \omega_t$

State equation: $sv1_t = sv1_{t-1} + \xi_t^1$, $sv2_t = sv2_{t-1} + \xi_t^2$, $sv3_t = sv3_{t-1} + \varepsilon_t^3$ (19)

To simplify the analysis process, the state vectors are in the form of simple recursive here. ω_t, ξ_t^1, ξ_t^2, ε_t^3 are independent and identically distributed residuals, who are also invariant variance and non-serial correlation.

Figure 1 shows the effect of housing prices on investor's consumption. Figure 2 shows that there are also fluctuations of the effect of housing prices on improvement consumer's consumption during 2006-2011. Figure 3 shows the effect of prices on welfare consumer's consumption. We can also see the different effects on three different households during the same period from Figure 4. The solid line represents the investors, long-dashed line represents the improvement consumers, and short dashed line represents the tenants. These four figures prove the point of this article.

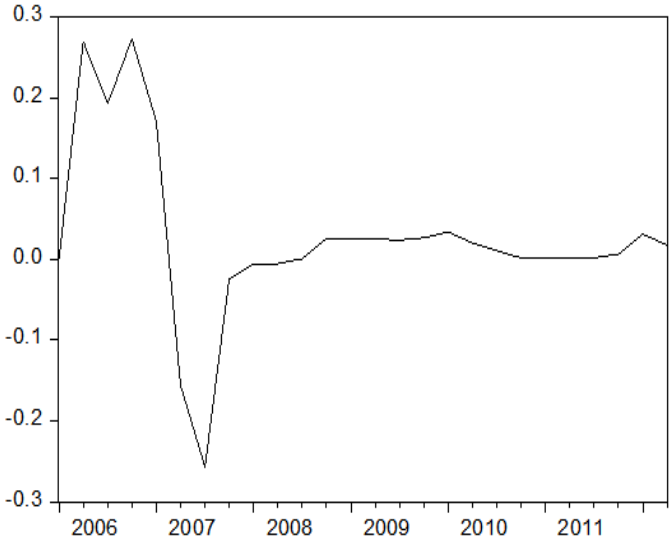

FIGURE 1. Effect of prices on investor's consumption

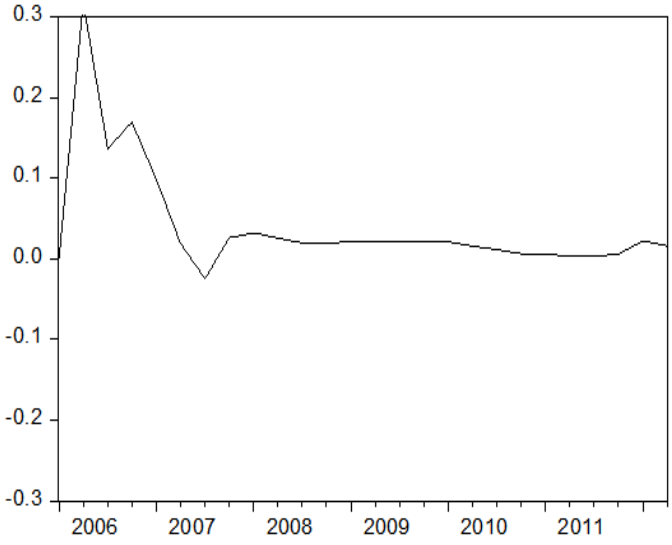

FIGURE 2. Effect of prices on improvement consumer's consumption

4. **Conclusions.** We hold that a house is a kind of special commodity that has consumption, investment and welfare attributes. Because tenants are included in consumers when prices are low, the tenants and consumers are in the same boat when housing prices started to creep up. Improvement consumers have already owned houses; rising prices will

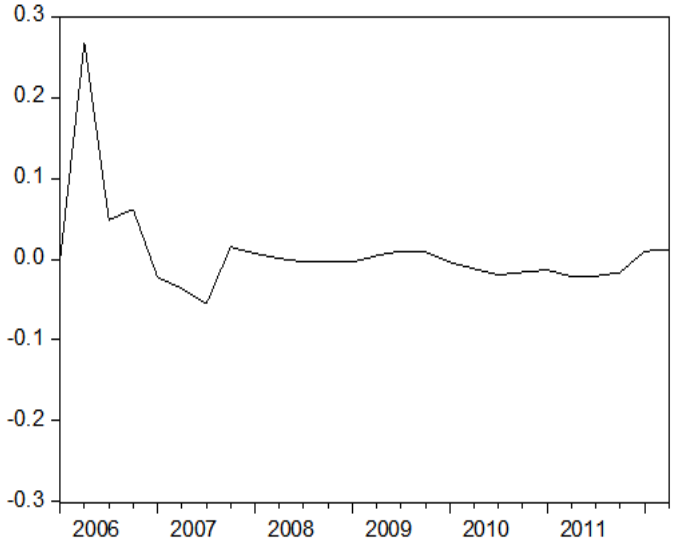

FIGURE 3. Effect of prices on welfare consumer's consumption

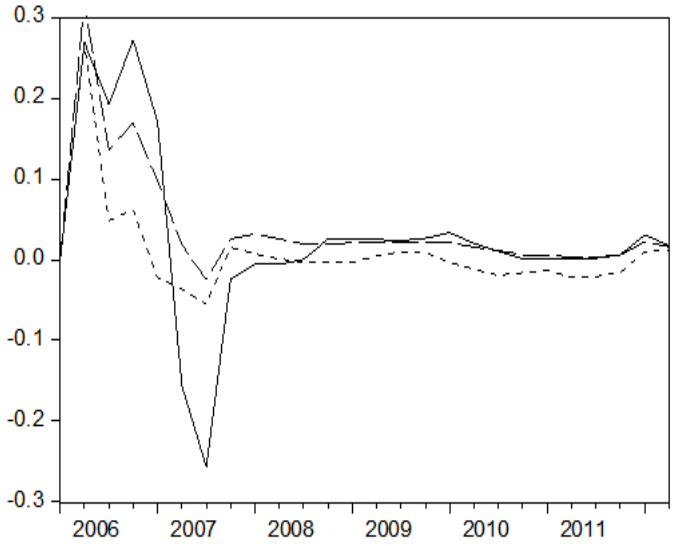

FIGURE 4. Comparison of three kinds of effects

not only increase their wealth but will increase the cost of purchasing new. The incomes of investors are proportional to the prices. In summary, the needs of both improvement consumers and investors can be met before the prices rise to a inflection point. And these two groups will have contradictions after prices exceed it. Also there are no compromise between investors and tenants when taking into account the requirements of prices and the purchase motivation.

In the future, this research will develop a set of methods suitable for analyzing this special commodity of housing. We strive to summarize and refine the theorems of universal applicability from the perspective of economic theory and the characteristics of housing itself.

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