Accounting for the Household Saving Rates in China*

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Background

- ✧ With close to 40%, China presents one of the highest household saving rates in the world. Accompanied are two features of Chinese economy, rapid economy growth and serious economic imbalance.
- ✧ Thus, understanding why Chinese household save so much has brought considerable interests from economists.
  - ✓ Firstly, rapid economic growth and borrowing constraints can be the origin of high saving in China (Wen, 2009).
  - ✓ Secondly, the demographic dividend in recent years leads to high household saving rate in aggregation (Modigliani and Cao, 2004).
  - ✓ Thirdly, the gender imbalance in China stimulates saving behavior. Relative surplus of males makes them to save in order to win in the marriage market (Wei, 2009).

- ✓ Fourthly, the increase of potential education expenditure will lead to a higher household saving rate (Yang and Chen, 2009), because people have to save for the extra expenditure in the future.

✧ However, few of these researches take into account an important asset: house. Chinese have a great demand for house. House accounts for more than 70% in household assets. (it is less than 50% in U.S.) In addition, Chinese have a strong homeownership preference. The homeownership rate in China is as high as 82%, while that of U.S. is only 67%.

A brief view on this paper

Purpose：Accounting for the household saving rates in China

Approach：Incorporating housing into Bewley model

Introduction of Bewley model

- Bewley models have two features: incomplete market (borrowing constraint), heterogeneous households (thus the wealth distribution is endogenous.)
- Ljungqvist and Sargent's *Recursive Macroeconomic Theory* (2000) provides a very good textbook.
- Bewley (1977, 1980, 1983, 1986) first use to study a set of classic issues in monetary theory.
- Now researchers have used calibrated versions of Bewley models to give quantitative answers to questions including:
  - the welfare costs of inflation (Imrohoroglu, 1992; İmrohoroğlu and Prescott, 1991; Algan, Challe and Ragot, 2009; Akyol, 2004)
  - the risk-sharing benefits of unfunded social security systems (Imrohoroglu, Imrohoroglu, and Joines, 1995)
  - the benefits of insuring unemployed people (Hansen and Imrohoroglu, 1992)

- the saving theory (Hubbard，Skinner and Zeldes, 1995; Carroll, 1997; Wen, 2009b),
- the wealth inequality (Aiyagari, 1994; Quadrini, 2000; Krusell and Smith, 1998; Yanbin CHEN et al., 2009; Díaz, Pijoan-Mas and Ríos-Rull, 2003; Huggett, 1996; De Nardi, 2004; Hendricks, 2007; Silos, 2007; Díaz and Luengo-Prado, 2009; Gokhale, 2001; Cagetti and De Nardi, 2006; Nishiyama, 2002; Castañeda，Díaz-Giménez and Ríos-Rull, 2003), the cost of business cycles (İmrohoroğlu, 1989; Storesletten, Telmer, and Yaron, 2001; Mukoyama and Sahin, 2006),
- the welfare costs of taxing capital (Aiyagari, 1995; Conesa，Kitao and Kruger, 2009; Meh, 2009; Kitao, 2008; Conesa and Kruger, 2006; Erosa and Koreshkova, 2007; Cagetti and De Nardi, 2009),
- the housing (Fernández-Villaverde and Kruger, 2002; Iacoviello and Pavan, 2009; Cho, 2008; Yang, 2009; Chambers, 2009a; Silos, 2007; Iacoviello and Pavan, 2009).

Mechanism：

In our model, we incorporate housing expenditure as a source of saving. On one hand, the demand for housing crows out consumption thus higher share of housing in utility leads to higher saving rate; on the other hand, a higher saving rate can also be driven when people purchase new house as a result of income growth.

Result：

While calibrated to match some key feature of China's reality, our framework fits a number of facts well including the wealth concentration, homeownership rate, housing distribution, and household saving rates for each income quintile. The fact that our simple model matches well along so many dimensions qualifies it to deserve our faith when accounting for the Chinese household saving rates.

Conclusion：

1、The intensive demand for house in itself is essential to account for the household saving rates in China.

2、The change of housing market influence household saving rate slightly. A smaller minimum housing value and a less house-selling cost can both lead to a slightly higher saving rate because both of them implies more frequent housing transaction. While lessening the downpayment ratio can generate a lower saving rate.

3、Homeownership preference has an apparent impact on homeownership ratio yet can not affect the household saving rate obviously.

I. Facts on Household Saving and Housing

A. Household saving

Definition：household saving rate is equal to the ratio of aggregate saving of household sector to its disposal income.

In 2007，the household saving rate is as high as 37.9% in China, which is apparently higher than those in several developed countries. The household saving rate in German is 11%, that of Japan is 3%, and U.S. is nearly 0%.（as shown in Table 1）.

Table 1 Household Saving Rates in Several Countries

	China	U.S.	Japan	Germany
Household Saving Rate	38%	0%	3%	11%

Table 2 lists the saving rate of each quintile households in 2007. We find household saving rate is positively related to income level: the saving propensity rises significantly when income becomes higher, which is consistent with the finding of Dynan，Skinner and Zeldes (2004). For simplicity, we adopt this saving rate distribution as the description of our whole China.

Table 2　Household Savings Rate by Income Quintiles

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Saving Rates	9.7%	20.0%	24.5%	29.4%	34.5%

B. Housing

Introduction to housing in China goes along two dimensions: housing market and housing holding.

We debrief housing market first. On one hand, it has a large scale, in 2007, sales from housing accounts for 10% in the GDP of China; on the other hand, it contains some key components as follows:

- Mortgage. Mortgage available: 70%, downpayment.
- Housing purchase. Housing purchase cost comprises of contract tax, maintenance fund, transaction cost, and appraisal fee.
- Housing selling. You need to pay dump duty, sales tax, and personal income tax.

Then we have a look at the housing holding. China shows a really high homeownership rate. In 2007, 82.3% of the population have self-owned house. The number in U.S. is 67%, calculated through SCF 2007.

Table 3 reports the homeownership rates along the income dimension. We notice that the homeownership rate rises with income level. Also, the homeownership rate in China is all higher than that in U.S. almost at every income level. Even the poor needs self-owned housing in China.

Table 1 Homeownership Rates for Each Earning Group

	All	Quantile 1	Quantile 2	Quantile 3	Quantile 4	Quantile 5
China	82%	75%	80%	83%	86%	87%
U.S.	67%	37%	54%	69%	84%	94%

C. Relationship between household saving and housing

Table 4 Net Assets Composition of Households

Assets	House	Deposit	Stock	Business	Cash	Bond	Others
Ratio	71.3%	16.3%	4.1%	3.5%	2.2%	0.8%	1.8%

Housing is the main asset for households, it accounts for more 70% in net wealth (as in Table 4). This means the direction of saving is mainly housing.

Table 5 Saving Flows in Household Disposable Income

Household Saving	Housing Investment	Deposit Increased	Others
0.379	0.190	0.095	0.094

Half of household saving is used to purchase housing, 1/4 forms deposit. In contrast, only 5.2% of its household saving becomes housing in U.S..

II. The Model

A. Demographics

Households go through two stages in our model, young and elderly, following Gertler(1999). At each period, a young person faces a constant probability of aging $\left(1-\pi_y\right)$, and an elderly faces a constant probability of dying $\left(1-\pi_e\right)$. When an elderly dies, his offspring will be born and enter the model, carrying all the assets bequeathed to him by the parent.

The economy is populated by a continuum of agents of measure one, where the measure of elderly is N_e and that of young is N_y. There is no population growth in the economy thus the demographic is always in its steady state.

B．Preferences

Denote h as owned house and d as rented.

Then, when the household is homeowner, the utility flow is given by:

$$u^o\left(c,h'\right)=\left(1-\theta\right)\ln c+\theta\ln h',$$

and when the household is renter, the utility flow is given by:

$$u^r\left(c,d\right)=\left(1-\theta\right)\ln c+\theta\ln\left[\left(1-\psi\right)d\right],$$

where c is the consumption and $\theta\in(0,1)$ represents the share of housing in utility.

The households' subjective discount rate is β and parents are perfectly altruistic toward their offspring, regarding their descendants' utility flow as their own.

C. Technology

Production sector produces with capital K and labor N. Denote A as labor productivity, it grows at a constant annual rate of g as in Wen (2009). The production technology is represented by a Cobb-Douglas production function:

$$Y = f\left(K, AN\right) = \left(K\right)^{\alpha}\left(AN\right)^{1-\alpha}.$$

Gross output is composed of consumption C, the productive investment I_k and housing investment I_h:

$$Y = C + I_k + I_h.$$

Productive investment reflows into production sector while housing investment does not participate in the production process. The depreciation rate of those two capitals are δ_k and δ_h respectively. The laws of motion are given by:

$$K' = I_k + (1-\delta_k)K,$$
$$H' = I_h + (1-\delta_h)H.$$

There is a stochastic shock s on the working ability of the young. This stochastic shock subjects to a logarithm AR(1) process and is given by:

$$\ln s' = \rho \ln s + \sigma_\varepsilon \varepsilon', \quad \varepsilon' \sim N(0,1).$$

After retirement, the elderly supplies no labor; yet his working efficiency remains until death.

The competitive equilibrium factor prices are given by:

$$r = \alpha (K/AN)^{\alpha-1} - \delta_k,$$
$$w = A(1-\alpha)(K/AN)^{1-\alpha}.$$

D. Government

The government assumes considerable responsibilities in terms of transferring pension, keeping capital structure, levying, and achieving its budget balance. We describe them in details as follows.

The Chinese government taxes labor income to transfer pension to the retired. For simplicity, we assume the pension is completely from taxing young by a constant rate τ_b. The elderly receive pension by a fixed percentage b of their labor income level at retirement. The balance of pension system is given by:

$$b\left(1-\tau_b\right) wN_e = \tau_b wN_y .$$

In order to achieve that target above, the government should get fiscal revenue first, an important approach is to levy. We assume that government only levies proportional capital income tax in order to simplify tax system. We set tax rate to be τ_k, then the capital income tax revenue is $\Gamma_k = \tau_k rK$.

Since the state-owned capital must be dominant in China, government will keep a specific capital structure if we divide the total capital in economy into the following three parts:

$$K = K_{state} + K_{gov} + K_{households},$$

where K_{state} is state-owned capital in corporations, K_{gov} is government capital and $K_{households}$ is the capital held by households.

After obtaining fiscal revenue, government then can keep the share of state-owned capital in aggregate capital stock μ constant by transferring capital Tr to state-owned enterprises:

$$K_{state} = \mu K,$$
$$\left(1-\tau_k\right) rK_{state} + Tr = gK_{state}.$$

At last, the government should make its budget balanced. Denote the government disposable income, government consumption and government saving rate as Λ, G_c, and η respectively. Then the government budget constraint is given by:

$$\Lambda = \left(1-\tau_k\right) rK_{gov} + \Gamma_k - Tr,$$
$$G_c = \left(1-\eta\right)\Lambda,$$
$$\eta\Lambda = gK_{gov}.$$

The after-tax interest rate and wage rate is given by:

$$\tilde{r} = \left(1-\tau_k\right) r,$$
$$\tilde{w} = \left(1-\tau_b\right) w.$$

E. Housing Market

Calling for a balance between computational conveniences and not losing the main facts of housing market, we portray several key characters of housing as follows in the tradition of Iacoviello and Pavan (2009) and Díaz and Luengo-Prado (2010).

House is illiquidity property with non-negligible transaction cost, which is a fixed proportion of house value. Denote the transaction cost of purchase a house as τ_p, and that of selling a house as τ_s, then the transaction cost is:

$$\Omega(h,h') = I_{\{h' \neq (1-\delta_o)h\}} \bullet \left(\tau_s h + \tau_p h'\right),$$

Housing can serve as collateral. Mortgage is available when the household has the housing property. The amounts of this mortgage are no more than a fixed percentage $(1-\lambda)$ of the housing value:

$$a' \geq -(1-\lambda)h',$$

where λ implies the downpayment ratio to purchase a new house.

There is a minimum housing value $h_{\min}$ when purchasing a house, which is a ratio on the income level. Self-owned house can have a value less than it before sold out.

There is a financial intermediate, following Chen (2009) and Iacoviello and Pavan (2009). It collects chummage and borrows from commercial banks to build houses for renting and selling, it also modifies sold houses to new ones.

Since the market is completely competitive, the housing rent r_{rent} should meet the no-arbitrage condition (See Chen 2009 for more details). Financial intermediate earns zero, requesting the earning $r_{rent}(1+\tilde{r})$ from building and leasing a house out equals its opportunity cost $\tilde{r}+\delta_h$, thus:

$$r_{rent} = \frac{\tilde{r}+\delta_h}{1+\tilde{r}}.$$

F. Households' problem

The value function of a young individual is:

$$V(a,h,s) = \max\left\{V^o(a,h,s), V^r(a,h,s)\right\},$$

where $V^o(a,h,s)$ is the value function when the young chooses to own a house and $V^r(a,h,s)$ is the value function when he chooses to rent.

The value function for the young homeowner is given by:

$$V^o(a,h,s) = \max_{\{a',h'\}}\left\{u^o(c,h') + \beta\pi_y EV(a',h',s') + \beta(1-\pi_y)EW(a',h',s')\right\},$$

subject to

$$c + a' + h' + \Omega(h,h') \le (1+\tilde{r})a + b\tilde{w}s + (1-\delta_h)h,$$

$$-(1-\lambda)h' \le a',$$

$$0 < d,$$

$$0 < c.$$

The value function for the young renter is given by:

$$V^r(a,h,s) = \max_{\{a',d\}} \left\{ u^r(c,d) + \beta \pi_y EV(a',0,s') + \beta(1-\pi_y) EW(a',0,s') \right\},$$

subject to

$$c + a' + h' + \Omega(h,0) \le (1+\tilde{r})a + \tilde{w}s + (1-\delta_h)h,$$
$$0 \le a',$$
$$0 < d,$$
$$0 < c.$$

The value function of an elderly is

$$W(a,h,s) = \max\left\{ W^o(a,h,s), W^r(a,h,s) \right\},$$

where $W^o(a,h,s)$ is the value function when the elderly chooses to own a house and $W^r(a,h,s)$ is the value function when he chooses to rent.

The value function for the elderly homeowner is given by:

$$W^o(a,h,s) = \max_{\{a',h'\}} \left\{ u^o(c,h') + \beta\pi_e EW(a',h',s') + \beta(1-\pi_e) EV(a',h',s') \right\},$$

$$\text{subject to} \quad \begin{aligned} c + a' + h' + \Omega(h,h') &\le (1+\tilde{r})a + b\tilde{w}s + (1-\delta_h)h, \\ -(1-\lambda)h' &\le a', \\ 0 &< h', \\ 0 &< c. \end{aligned}$$

The value function for the elderly renter is given by:

$$W^r(a,h,s) = \max_{\{a',d\}} \left\{ u^r(c,d) + \beta\pi_e EW(a',0,s') + \beta(1-\pi_e) EV(a',0,s') \right\},$$

$$\text{subject to} \quad \begin{aligned} c + a' + h' + \Omega(h,0) &\le (1+\tilde{r})a + b\tilde{w}s + (1-\delta_h)h, \\ 0 &\le a', \\ 0 &< d, \\ 0 &< c. \end{aligned}$$

G. Equilibrium

We now define a stationary recursive competitive equilibrium for the benchmark economy. For notation efficiency, we denote $X = \{A \times H \times S \times Z\}$ as state space, and $x = (a, h, s, z)$ as individual state vector where z distinguishes young homeowners, young renters, elderly homeowners and elderly renters. A stationary equilibrium is given by an after-tax interest rate and an after-tax wage rate $(\tilde{r}, \tilde{w})$, a set of government targets $(\mu, \eta, \tau_b, \tau_k)$, a set of value functions and policy functions for household problems $\{V(x), W(x); \vartheta^a(x), \vartheta^h(x), \vartheta^c(x), \vartheta^d(x)\}$, and a distribution of households over the state variables $\Phi(x)$, such that:

1. $\{V(x), W(x); \vartheta^a(x), \vartheta^h(x), \vartheta^c(x), \vartheta^d(x)\}$ solves households' problem.
2. Total labor services are obtained by aggregating labor supply of young

workers $N = N_y$.

3. State-owned capital K_{state} and government owned capital K_{gov} satisfies the government target.

4. $K = K_{state} + K_{gov} + \int_X \left[\mathcal{G}^a(x) - \mathcal{G}^d(x) \right] d\Phi(x)$ (Capital market clears).

5. Factor rental price $(\tilde{r}, \tilde{w})$ satisfies marginal conditions of production function and the set of tax rate of the governments (τ_k, τ_b).

6. The rental price of housing satisfies the no-arbitrage condition.

7. The good market clears:

$$Y = \int_X \left[\mathcal{G}^c(x) + (g + \delta_h) \mathcal{G}^d(x) + \mathcal{G}^h(x) - (1 - \delta_h) h + \Omega\left(h, \mathcal{G}^c(x)\right) \right] d\Phi(x) + G_c + (g + \delta_k) K.$$

8. The distribution of household $\Phi(x)$ is stationary.

III. Calibration

The parameters in Table 6 are all exogenous and are not used to adjust the model's results.

Table 6 Fixed Parameters and Their Sources

Parameters	Values	Remarks
Technology		
α	0.50	Huang Zelin（2005）
g	0.08	Our estimates
δ_k	0.05	Chow and Li（2002）
δ_h	0.02	Account Convention in China
Demographics		
π_y	0.975	Average Working Years: 40 Years
π_e	0.923	Average Retirement Years: 13 Years

Income Process		
ρ	0.98	Our Inference
Earning Gini	0.42	Aordo 2005
Housing Market		
λ	0.30	Average Level in China
τ_p	0.00	Our Assumption
τ_s	0.05	Our Estimates
Public Sector		
τ_b	0.08	Urban Pension Burden
τ_k	0.50	Our estimates
μ	0.33	The Second National Economic Census
η	0.36	Average of this ratio from 2000 to 2007

We use four parameters to replicate four macroeconomic variables.

Table 7 Calibrated Parameters and Targets

Parameters	Values	Targets	Values	Sources
β	0.995	Equilibrium Interest Rate	0.064	China's Wealth Report
θ	0.30	Housing to Wealth Ratio	0.713	Aordo 2005
ψ	0.35	Homeownership Rate	0.823	NBS 2007
$h_{\min}$	3.00	House Price to Income Ratio	5.560	NBS 2007

IV. Results of Benchmark Model

A. National Accounting

Tables 8 compares some data for the Chinese economy and for the model-generated data in terms of production approach calculated GDP; our model is consistent to the reality much.

Table 8. GDP by Production Approach （GDP is normalized to 1）

	Labor income	Properties income	Net taxes of production	Depreciation of Fixed Assets
Data	0.487	0.170	0.177	0.166
Model	0.501	0.184	0.184	0.132

Table 9 reports the disposable income and savings by sectors for both the actual economy and our modeled one. We find our model matches the data well.

Table 9. Disposable Income and Saving by Sectors （GDP = 1）

		Corporations	Governments	Households	Total
Disposable Income	Data	0.184	0.241	0.575	1.000
	Model	0.202	0.254	0.545	1.000
Savings	Data	0.184	0.087	0.218	0.509
	Model	0.202	0.091	0.198	0.490

B. Wealth Distribution

Table 10. Wealth Distribution

		Percentage of Wealth held by top			
	Wealth Gini	Top 5%	Top 10%	Top 20%	Top 40%
Data	0.65	0.34	0.47	0.65	0.86
Model	0.64	0.25	0.42	0.67	0.87

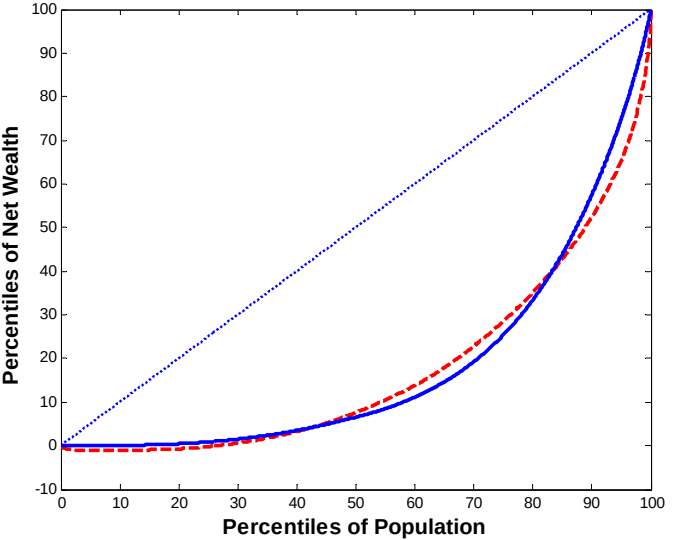
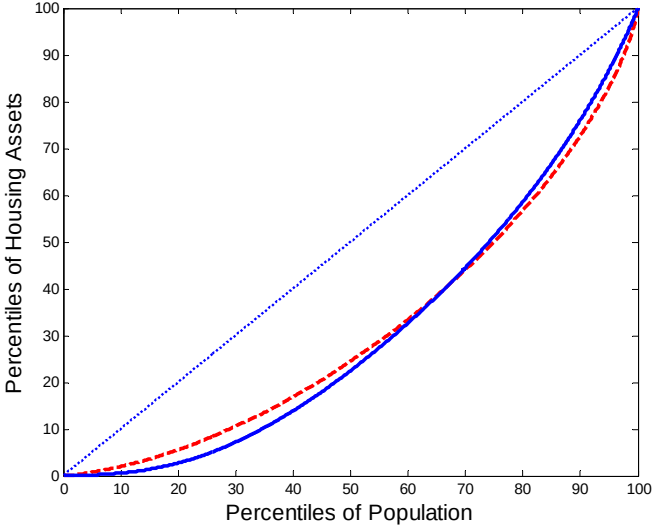

Percentiles of Net Wealth
Percentiles of Population
100
90
80
70
60
50
40
30
20
10
0
-10
0
10
20
30
40
50
60
70
80
90
100

Table 11. Homeownership

	Homeownership Rates for different income groups					
	All	Quantile 1	Quantile 2	Quantile 3	Quantile 4	Quantile 5
Data	0.82	0.75	0.80	0.83	0.86	0.87
Model	0.84	0.60	0.80	0.84	0.96	1.00

Table 12. Housing Distribution

	Percentage of Housing held by top homeowners				
	Housing Gini	Top 5%	Top 10%	Top 20%	Top 40%
Data	0.38	0.17	0.27	0.43	0.67
Model	0.39	0.13	0.24	0.41	0.67

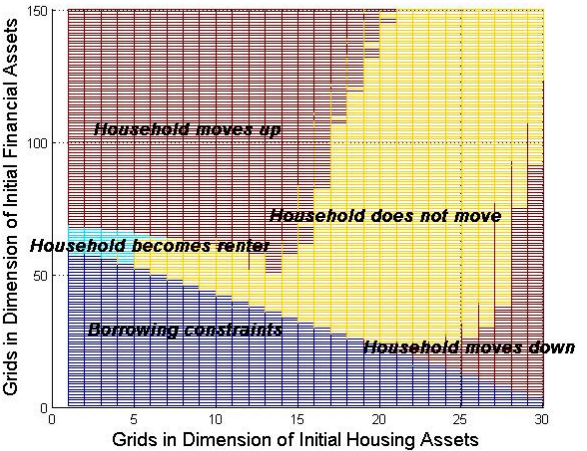

Percentiles of Housing Assets
Percentiles of Population
0
10
20
30
40
50
60
70
80
90
100

C. Household Saving Rates

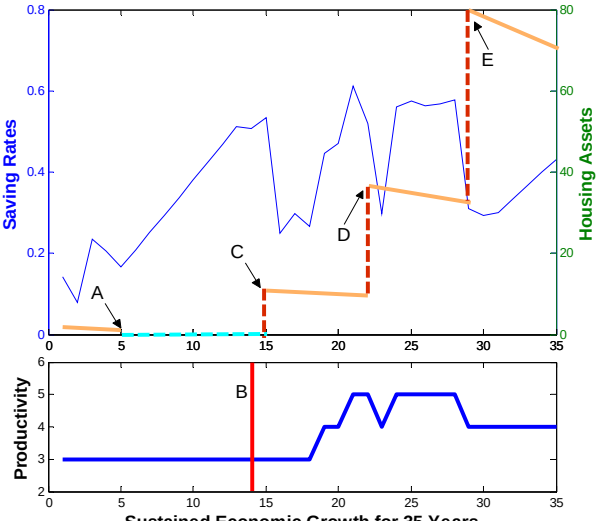
Table 13. Household Saving Rates

	Household Saving Rates for Different Income Groups					
	All	Quantile 1	Quantile 2	Quantile 3	Quantile 4	Quantile 5
Data	0.379	0.097	0.200	0.245	0.294	0.345
Model	0.363	0.101	0.133	0.224	0.306	0.526

D. Saving Patterns of a Typical Household



1. Household purchase a house when there are too few housing assets last period and enough financial assets this period (Households moves up). This can be caused by two circumstances. One is the individual has accumulated enough to pay the downpayment; another is to replace the original house with a new one due to the rapid rise of income thus the accumulation of the financial assets.
2. There are more than enough housing assets but too few financial assets, then the households would sell his house (Households moves down), which is frequently due to the sharp decline of the income.
3. Household remains in his original housing (Household does not move). This situation is the majority, where his financial assets are neither enough to purchase a new house, nor too few to sell the house.
4. Choose to rent a house (Household becomes renter). The circumstance is either due to the household has not accumulated enough money to purchase a new house, or due to that the household has to sell the existing house and rent one since the existing one can't meet the demand any more but he can't afford a new one.


Saving Rates
Housing Assets
Productivity
Sustained Economic Growth for 35 Years
A
B
C
D
E
0.8
0.6
0.4
0.2
0
80
60
40
20
0
6
5
4
3
2
0
5
10
15
20
25
30
35

From the year 1 to 13, the individual is old and earns median income. At the year 5 (Point A), the elderly wants to improve his housing condition, hence he sells the existing house and rent a larger house. From the year 5 to 14, there is an obvious rise of his saving rate when the elderly is accumulating wealth to purchase a new house.

At the year 14 (Point B), the elderly passes away and all the assets are inherited by his offspring. The income of this descendant is also medium. The second year after he inherits from parent, namely at the year of 15 (Point C), the descendant purchased a new house. We can observe there is a sharp decline of saving rate on the right of Point C.

At the year 19, 12, 23, 24 and 29, the descendant encounters with 5 income shocks. The saving rate fluctuates with the change of the income level. And during these years, he purchases a new house (Point D).

After purchasing a new house at the year 29 (Point E), the descendant's income level is stable. The descendant wants to further improve his housing condition hence makes evident rises in his saving rate.

The saving path of this typical household shows that:

1. The household saving rate is influenced by the income level. Higher income usually generates higher saving rate.
2. The saving rate before the housing purchase is higher than that after the purchase. When the individual wants to purchase a house, the saving rate would rise; while after the purchase, the saving rate would decline.
3. The elderly will save to help his offspring to purchase a house.

V. Experiments on Housing

A. Change the Housing Market Frictions

We examine the change in household saving rates by lowering the downpayment ratio, minimum house value, and transaction costs respectively.

Table 14. Changing the Housing Market Frictions

	Benchmark	$\lambda = 0.10$	$h_{\min} = 2.00$	$\tau_s = 0.02$
After-tax Interest Rate	0.069	0.071	0.070	0.070
Capital to Output Ratio	2.649	2.612	2.637	2.646
Housing to Output Ratio	1.456	1.414	1.442	1.500
Housing to Wealth Ratio	0.674	0.708	0.692	0.684
Loan to Output Ratio	0.224	0.327	0.244	0.227
Homeownership Rate	0.840	0.890	0.882	0.841
House Price to Income Ratio	5.414	6.000	4.536	5.410
Gini Coefficient of Net Worth	0.643	0.672	0.647	0.641
Gini Coefficient of House	0.388	0.392	0.393	0.370

National Saving Rate	0.490	0.481	0.487	0.494
Household Saving Rate	0.363	0.356	0.367	0.370

We find that the household saving rates decreases slightly when the downpayment ratio decreases from 30% to 10% (3rd column). With the decrease in downpayment, households in model will purchase more houses. As a result, the "Housing to Wealth Ratio", "Loan to Output Ratio", "Homeownership Rate" and "House Price to Income Ratio" shows substantial increase. However, rented house reduces, which is reflected by the decrease in "Housing to Output Ratio" and the meanwhile increase in "Housing to Wealth Ratio". Therefore, the housing stock and saving rates does not increase as a result of the substitution between renting and buying houses.

When the minimum house value reduces from triple to double the average wage, the household saving rates increase slightly (4th column). The decrease of minimum house value leads households to purchase house directly instead of a

period of wealth accumulation. Therefore the “Housing to Wealth” increases significantly and lowers the overall “House Price to Income Ratio”. However, the change of housing caused by the minimum housing value is still a transformation from the renters into homeowners. This does not have significant impact on the household saving rates eventually.

Moreover, when the house selling transaction cost decreases from 5% to 2% (5th column), the “Housing to Output Ratio” rises most obviously, followed by the “Housing to Wealth Ratio”. Meanwhile, the household saving rates rise slightly with other variables almost being constant. This is because the decline in the cost of housing transaction will raise the frequency of housing transaction, thereby making the real estate a more attractive form of investment. Also, previous housing transaction costs can be used to buy new house, thus the housing stock will rise, causing a slight increase in household saving rates.

B. Change the Housing Preference

We also address the effect of the share of housing in utility and homeownership preference on household saving rates.

Table 15. Changing the Housing Preference

	Benchmark	$\theta = 0.20$	$\psi = 0.20$
After-tax Interest Rate	0.069	0.070	0.070
Capital to Output Ratio	2.649	2.644	2.637
Housing to Output Ratio	1.456	1.013	1.452
Housing to Wealth Ratio	0.674	0.602	0.666
Loan to Output Ratio	0.224	0.189	0.216
Homeownership Rate	0.840	0.811	0.797
House Price to Income Ratio	5.414	4.933	5.709
Gini Coefficient of Net Wealth	0.643	0.663	0.648
Gini Coefficient of Housing Owned	0.388	0.385	0.369
National Saving Rate	0.490	0.445	0.488
Household Saving Rate	0.363	0.287	0.367

When the share of housing in utility drops from 0.30 to 0.20 (3rd column), all the housing-related indicators, e.g. “Housing to Output Ratio”, “Housing to Wealth Ratio”, “Loan to Output Ratio”, “Homeownership Rate” and the “House Price to Income Ratio” decrease obviously, Meanwhile, the household saving rate drops by 7.6 percentage points. It is because the incomes previously for housing are now used in consumption.

And when the homeownership preference declines from 0.35 to 0.20 (4th column), the “Homeownership Rate” falls by 4.3 percentage points, while the “House Price to Income Ratio” increases by what is equivalent to the average wage of three months. The household saving rates does not decline but increases slightly.

Since household has strict preference on self-owned house as long as the homeownership preference rate is above 0 thus all renters rent because of lacking money, the reduction in homeownership preference implies individuals will give up accumulating for purchasing house and turn to rent one. However, only a larger rented house can sustain previous utility and it still costs to rent, the saving rate eventually goes up.

C．Model without Housing

Table 16. Model without Housing

	Benchmark	No Housing
After-tax Interest Rate	0.069	0.054
Capital to Output Ratio	2.649	3.171
Gini Coefficient on Net Wealth	0.643	0.682
National Saving Rate	0.490	0.410
Household Saving Rate	0.363	0.186

The “Capital to Output Ratio” rises obviously and the “Household Saving Rate” shows a sharp decline. The reason is that part of the savings which went to housing previously now flows into the production sector, which raises the “Capital to Output Ratio”. Generally, the household saving rate fall significantly since there is no longer need to save for housing.

We also compare the saving rates of each income group between the benchmark model and the one without housing. The saving rate of each income groups declines by a similar scale, about 20%. And the household aggregate saving rate drops by 17.7% correspondingly.

Table 17. Household Saving Rates

	Household Saving Rates for Different Income Groups					
	Average	Quantile 1	Quantile 2	Quantile 3	Quantile 4	Quantile 5
Benchmark	0.363	0.101	0.133	0.224	0.306	0.526
No Housing	0.186	-0.080	-0.060	-0.006	0.091	0.318
Difference	-0.177	-0.181	-0.193	-0.230	-0.215	-0.208

Our experiments imply the change of housing market frictions have little influence on household saving rates. Vary in homeownership preference does not affects the saving rate apparently either.

We do not find a substitute way capable of replicating the household saving rates in China without housing thus far and we believe housing in utility is essential in accounting for the Chinese household saving rates.