Getting Rich in China: an Empirical and Structural Investigation of Wealth Mobility

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Abstract

We study the properties of individual wealth growth and mobility in China using the China Household Finance Survey. We find that capital gains is the most important factor in generating wealth mobility while individual savings play a minor role. The second finding is that housing wealth is important for wealth mobility due to the high share of housing in household portfolios and the large cross-sectional dispersion in housing capital gains. The third finding is that wealth mobility increases with households' debt. To capture these features of the Chinese economy we construct a general equilibrium model where households choose three types of assets: housing, stock market investment and risk-free bonds (or debt when negative). We then use the calibrated model to explore the consequences of financial development and policies on wealth distribution and mobility.

Introduction

It is well known that wealth is highly concentrated. Much more concentrated than earnings, income and consumption. However, the properties of

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wealth mobility—that is, the change in individual wealth over time—are less known. This is because longitudinal data that tracks individual assets over time is more limited than cross-sectional data. As a result, most empirical studies focus on cross-sectional comparisons which do not inform us about the movement of individual households within the distribution of wealth. In this paper we explore the properties of wealth mobility in China using the China Household Finance Survey (CHFS).

The CHFS is similar to the Survey of Consumer Finances (SCF) for the United States but with the additional longitudinal feature. The survey is conducted every two years, starting in 2011. There are several studies that use the cross-sectional dimension of the CHFS but very few explore the longitudinal dimension of the survey to study wealth mobility. One exception is Zeng and Zhu (2019) who documented preliminary facts on earning, income, and wealth mobility for the upper income groups. This study, however, does not conduct a detailed analysis of the possible driving forces affecting wealth mobility.

The main goal of our paper is to identify some of the factors that facilitate the change in household asset holdings over time, that is, the growth rate of individual wealth. The results of our empirical analysis can be summarized in three main findings. First, individual savings play a relatively minor role in explaining wealth mobility. Although households with higher rates of saving experience on average higher growth rate of wealth, saving heterogeneity across households explains only a small fraction of variation in individual wealth growth. Instead, the most important force underlying the heterogeneity in individual wealth growth is the large dispersion in capital gains. The large dispersion in capital gains, which imply very heterogeneous returns on assets, indicates that households' wealth is very undiversified.

The second finding is that housing wealth is very important for wealth mobility. This is a consequence of two features of the Chinese economy. First, household wealth is mostly invested in housing. About 70 percent of household wealth is in housing. This is larger than in the United States. Second, there is significant cross-sectional dispersion in capital gains on housing. While the importance of housing wealth for Chinese households is well known, the large dispersion in capital gains on housing and their importance for mobility is relatively new. These empirical facts—large share of housing wealth and large dispersion in housing capital gains—further indicate that households' wealth is very undiversified in China and households portfolios are exposed to large idiosyncratic risks.

The third finding is the importance of households' debt for wealth mobility. Households that hold more debt relative to their assets (higher leverage) tend to experience greater volatility of wealth growth. This is intuitive since leverage increases the volatility of net worth in the same way it does for a leveraged firm. Although household borrowing is not very diffuse in China, those who borrow experience greater volatility of growth.

To summarize, we find that housing ownership and leverage are key factors in explaining individual wealth mobility in China. Households that allocate a larger fraction of their wealth in housing and finance their investments with debt are more likely to experience mobility—both upward and downward—due to the large idiosyncratic dispersion in housing capital gains. The heterogeneity in housing holding also implies heterogeneity in mobility across households.

The empirical findings raise several questions. If housing ownership is so risky, why do Chinese households hold so much housing wealth? Of course, this depends on the availability of alternative investment instruments such as corporate shares, which raises a related question: how does the privatization of state-owned enterprises—which enlarges the set of non-housing assets available to households—affect portfolio holdings? What would be the impact of privatization on wealth distribution and mobility? Another question relates to the importance of households debt: how would greater accessability of households to debt affect wealth distribution and mobility?

To address these questions we built a general equilibrium model where households choose three types of assets: housing, stock market and bonds (or debt when negative). Housing carries aggregate but also, and importantly, idiosyncratic risk. Stock market investment carries only an aggregate risk (since the stock market is more diversified than housing) while bonds (or debt if negative) has no risk.

After calibrating the model to the Chinese economy, we conduct two experiments. In the first we relax the financial constraints faced by households. Preliminary results show that higher debt generates higher wealth inequality. It also increases mobility but only for those with greater financial participation. In terms of macroeconomic effects, greater accessability to credit increases capital accumulation and aggregate production. The second experiment considers a policy in which the government privatizes state-owned enterprises. This increases the number of corporate shares that can be held by households. Effectively, this increases the stock market size and allows for greater households' diversification (with respect to the idiosyncratic risk).

Preliminary results suggests that such a policy reduces both inequality and mobility in wealth. The effects on capital accumulation and production, however, are negative. The two experiments conducted in the paper point out a trade-off between equality and macroeconomic performance. Greater accessability to credit and higher public ownership of productive capital have positive macroeconomic effects. However, they are also associated with greater wealth inequality.

1 Empirical analysis

A key variable for the analysis of this paper is the growth rate of individual wealth, which we denote by g_{wt}. The main goal of the analysis conducted in this section is to identify some of the factors that affect g_{wt}. To do so we first derive an expression that decomposes the growth rate of wealth in few components (Subsection 1.1). We will then use the data to explore how these components relate to some economically relevant factors (Subsection 1.2).

1.1 Accounting framework

Denote by W_t the net worth of an individual household at time t. We will also refer to W_t simply as 'wealth'. The growth rate of wealth between t and $t+1$, denoted by $g_{wt} = W_{t+1}/W_t - 1$, can be decomposed as follows:

$$\begin{aligned} g_{wt} &= \frac{g_t W_t}{W_t} + \frac{Y_t - C_t}{Y_t}\frac{Y_t}{W_t} \\ &= g_t + s_t r_t^W. \end{aligned} \tag{1}$$

The variable g_t is the capital gain on each unit of wealth, $s_t = \frac{Y_t - C_t}{Y_t}$ is the saving rate (with Y_t and C_t denoting, respectively, income and consumption), and $r_{wt} = \frac{Y_t}{W_t}$ can be thought as the return on wealth excluding capital gains. This decomposition uses a broad measure of wealth return which includes income from labor as if earnings were also generated by wealth.

We can further decompose this broad return on wealth—net of capital gains—into capital income return and labor income return, that is, $r_{wt} = \frac{Y_t^K + Y_t^L}{W_t} = r_t^K + r_t^L$, where Y_t^K and Y_t^L are, respectively, capital and labor incomes earned by an individual household. We can then rewrite the decomposition of wealth growth as

$$g_{wt} = g_t + s_t(r_t^K + r_t^L) \tag{2}$$

The empirical analysis will be based on Equations (1) and (2).

1.2 Data source

The main source of data is China Household Finance Survey (CHFS). The survey has been conducted bi-annually starting in 2011 and there are five waves available: 2011, 2013, 2015, 2017, 2019. However, since the measurement of consumption in the 2019 survey is not consistent with the previous years, we do not include the latest 2019 survey. A feature of the CHFS is that it samples the same households over time and allows us to track individual wealth over time. These dynamic features are studied by linking the 2011-2013 waves, the 2013-2015 waves, and the 2015-2017 waves. Although the cross-sectional aspects of the data has been used by other researchers, the use of the longitudinal dimension for the study of wealth mobility is fairly new.

There are some issues related to the timing in which income and wealth are measured in the survey. Wealth and its components (assets and liabilities) are observed in the middle of the survey years, that is, 2011, 2013, 2015 and 2017. Income and consumption, instead, are for the year prior to the year in which the survey has been conducted. This implies that income and consumption are available for the years 2010, 2012, 2014 and 2016 but not for years 2011, 2013, 2015 and 2017. To circumvent this problem, we proxy income and consumption for the missing years with the average of two adjacent years. Specifically, the proxy for 2011 is the average of 2010 and 2012; for 2013 we use the average of 2012 and 2014; for 2015 we use the average of 2014 and 2016.

The statistics that will be reported in the paper are based on the urban sample which is thought to be more accurate and affected by smaller measurement errors. This is especially important for the value of housing wealth. Nevertheless, the main results are similar if we include the rural sample. We do not report these extended results in the paper but are available upon request.

Mobility analysis is typically done by constructing transition matrices. A transition matrix computes, for the group of households located in a particular wealth class today (for example, those located in the first quintile), the distribution in the next period (that is, the percentage of households located in each of the wealth quintile next period). But ultimately, in order to move from one wealth class to the other, a household needs to experience growth in wealth. Therefore, in this study, we complement the analysis based on wealth transition matrices with the analysis of growth using the decompositions outlined in equations (1) and (2).

Table 1 reports the numbers that results from the decomposition of wealth growth based on equations (1) and (2). We first sort households into 5 quintile groups based on the growth rate of wealth (net worth). Then, for each group, we calculate group-level aggregate variables and use them to compute the statistics of interest. For example, for each quintile, we first calculate the group income $y_{qt} = \sum_{i \in q} \omega_{it} y_{it}$ and group consumption $c_{qt} = \sum_{i \in q} \omega_{it} c_{it}$, where ω_{it} is the survey weight assigned to household i. We then compute the group-level saving rate as $s_{qt} = \frac{y_{qt} - c_{qt}}{y_{qt}}$. The same approach is used to calculate the growth of wealth and the return on wealth.

The table 1 shows that there are significant differences in wealth growth rate among households. For example, focusing on the 2015-2017 panels, we see that the top quintile has a growth rate of 184.9% while the bottom quintile has a growth rate of -80.1%. A similar variation among the five groups is observed for capital gains. This already indicates that the major source of variation for wealth growth comes from these capital gains. In the appendix, we also report the results by sorting households with their initial wealth and the average wealth of two survey years, see Table 21 and Table 22.

1.3 Variance decomposition of wealth growth

To characterize the driving forces for individual wealth growth, we conduct a variance decomposition for the growth rate of wealth based on equation (1). For convenience we rewrite the equation here as

$$g_{wt} = 1 + \text{capital gain}_t + \text{saving}_t. \tag{3}$$

This allows us to compute the importance of two factors for the dispersion of wealth growth: capital gains and savings. The results for each of the linked surveys are reported in the top section of Table 2. As can be seen, most of the variation in wealth growth can be attributed to capital gains as they account for more than 80% of the variation in wealth growth.

Table (2) also conducts a variance decomposition for different sub-samples. We first separate households with and without housing debt. We then separate households that own one house from households that own multiple houses. Notice that by splitting the full sample in two sub-samples, we are eliminating the between-group variations of wealth growth.

Table 1: **Wealth growth across households (sorted by growth rates).**

	obs	g_{wt}	g_t	s_t	r_{wt}	r_{lt}	r_{kt}
			2011-2013				
Whole sample	3,705	19.4%	14.4%	26.8%	18.9%	11.9%	7.0%
Quintile 1	708	-59.3%	-61.3%	18.2%	11.0%	7.3%	3.7%
Quintile 2	733	-9.1%	-12.9%	25.0%	15.3%	9.9%	5.4%
Quintile 3	745	23.2%	17.3%	32.6%	18.2%	11.5%	6.7%
Quintile 4	735	63.8%	57.3%	27.4%	23.8%	15.0%	8.8%
Quintile 5	784	216.3%	204.5%	28.3%	41.5%	24.4%	17.1%
			2013-2015				
Whole sample	12,851	11.8%	7.2%	24.8%	18.5%	11.5%	7.1%
Quintile 1	2,749	-65.6%	-67.4%	15.0%	12.0%	8.6%	3.4%
Quintile 2	2,520	-17.0%	-20.7%	24.5%	15.3%	9.7%	5.6%
Quintile 3	2,459	10.2%	5.6%	27.1%	17.3%	10.8%	6.5%
Quintile 4	2,542	48.8%	42.8%	27.5%	21.9%	13.2%	8.8%
Quintile 5	2,581	187.9%	177.8%	27.0%	37.1%	20.4%	16.7%
			2015-2017				
Whole sample	15,742	13.8%	8.0%	30.0%	19.1%	11.8%	7.3%
Quintile 1	3,111	-80.1%	-82.0%	15.9%	12.3%	8.0%	4.3%
Quintile 2	3,068	-30.7%	-34.9%	27.2%	15.7%	10.2%	5.5%
Quintile 3	2,969	8.3%	2.2%	32.0%	18.9%	11.6%	7.3%
Quintile 4	3,300	50.1%	43.1%	33.9%	20.5%	12.6%	7.8%
Quintile 5	3,294	184.9%	173.3%	34.3%	33.8%	19.5%	14.3%

The table shows that capital gains account for a larger share of variance for households with housing debt and multiple houses. This suggests that borrowing against the owned house and owning multiple houses are important for wealth mobility.

Next we conduct a variance decomposition after sorting households in quintiles based on their initial wealth. The results are reported in Table 3. Since the wealth quintiles are calculated based on the initial wealth (for example, for the 2015-2017 matched samples, households are sorted based on 2015 wealth), low wealth households tend to grow faster and, mechanically, they have higher variance. But the key message is that capital gains are the

Table 2: **Variance decomposition of wealth growth.**

	Whole sample			
	Std	Gain	Save	Cov
2011-2013	1.18	81.63%	2.69%	15.68%
2013-2015	1.10	83.09%	0.95%	15.96%
2015-2017	1.07	83.92%	3.24%	12.83%

	Without housing debt				**With housing debt**			
	Std	Gain	Save	Cov	Std	Gain	Save	Cov
2011-2013	1.17	79.28%	2.66%	18.06%	1.21	93.84%	3.07%	3.08%
2013-2015	1.10	82.45%	0.74%	16.80%	1.08	86.89%	2.62%	10.49%
2015-2017	1.05	82.51%	2.63%	14.86%	1.12	90.09%	5.87%	4.04%

	One-house owner				**Multiple-house owner**			
	Std	Gain	Save	Cov	Std	Gain	Save	Cov
2011-2013	1.12	74.34%	1.95%	23.71%	0.84	94.60%	0.08%	5.32%
2013-2015	0.99	77.45%	0.53%	22.01%	0.73	94.50%	0.29%	5.21%
2015-2017	1.01	79.54%	1.85%	18.61%	0.78	94.72%	4.23%	1.06%

most important force for the volatility of growth for each wealth class and they increase with wealth.

Table 3: **Variance decomposition of growth for different quintiles of wealth based on initial wealth. Linked surveys 2015-2017.**

	Std	Gain	Save	Cov
Quintile 1	1.42	68.22%	3.64%	28.15%
Quintile 2	1.05	92.71%	2.64%	4.66%
Quintile 3	0.93	95.16%	3.22%	1.62%
Quintile 4	0.92	97.18%	4.04%	-1.22%
Quintile 5	0.79	98.78%	4.23%	-3.00%

Another way to look at the role of housing assets and housing debt in generating wealth mobility is with the construction of wealth mobility matrices. Table 4 reports the wealth mobility matrices for the full samples and the sub-samples of households with housing debt and multiple houses. The thresholds used to calculate the mobility in the sub-samples remain the same as those used for the whole sample. For economy of space we report here only the transition matrices for the last linked waves 2015-2017. The transition matrices constructed with the previous surveys are provided in the appendix.

Comparing the transition matrices for the whole sample and the two sub-samples we find that households with housing debt and households owning multiple houses are more likely to move upward and less likely to move downward. As we will see, this property is consistent with the regression analysis we will conduct later.

Table 4: **Wealth mobility matrices for whole sample and sub-samples with housing debt and multiple houses. Linked surveys 2015-2017.**

Whole sample (2011-2013)			
	Bottom	Middle	Top
Bottom	64.0%	30.9%	5.0%
Middel	18.5%	54.4%	27.1%
Top	7.1%	16.2%	76.7%

With housing debt (2011-2013)			
	Bottom	Middle	Top
Bottom	45.2%	44.2%	10.5%
Middle	11.1%	50.4%	38.5%
Top	5.5%	14.3%	80.2%

With multiple houses (2011-2013)			
	Bottom	Middle	Top
Bottom	60.3%	34.9%	4.8%
Middle	17.0%	49.5%	33.5%
Top	4.9%	15.3%	79.8%

1.4 The role of housing capital gains

We further decompose the capital gains into gains from housing assets and gains from other assets. To do so, we rewrite the wealth growth equation as:

$$\mathrm{d}W = H\mathrm{d}p + A\mathrm{d}q + S, \tag{4}$$

where $\mathrm{d}W$ is the growth of wealth (net worth). The variable H denotes the size of housing assets, p the price of houses, A the size of other assets and q the price of these other assets. Thus, $H\mathrm{d}p$ is the capital gain from owning houses, $A\mathrm{d}q$ is the capital gain from other assets, and S is saving.

In the data we do not observe, separately, the price of houses and the units of houses. Then, in order to proxy for capital gains on houses, we use the total change in the value of houses, $\mathrm{d}(Hp)$, instead of $H\mathrm{d}p$. This would be the right measure for the capital gains if households did not change the size and location of the owned houses over the two-year sample period. When they change housing size and/or location, our measure is only a proxy for the capital gains on houses.

Table 5 reports the variance for each component of wealth (housing, other assets and savings) as a percentage of the total variance. The top section of the table reports these statistics computed on the whole sample, while the statistics reported in the bottom section are computed on the restricted sample of households who do not change houses over the two-year period (they keep the same H). In this case, $H\mathrm{d}p$ captures only capital gains from housing. As can be seen from the table, capital gains on housing is the predominant source of variation for wealth growth.

Table 5: **Variance decomposition of wealth growth.**

	Housing assets $\frac{\mathrm{Var}(H\mathrm{d}p)}{\mathrm{Var}(\mathrm{d}W)}$	Other assets $\frac{\mathrm{Var}(A\mathrm{d}q)}{\mathrm{Var}(\mathrm{d}W)}$	Savings $\frac{\mathrm{Var}(S)}{\mathrm{Var}(\mathrm{d}W)}$	Covariances $\frac{\mathrm{Cov}}{\mathrm{Var}(\mathrm{d}W)}$
		Whole sample		
2011-2013	53.42%	26.73%	2.69%	17.16%
2013-2015	67.37%	15.29%	0.95%	16.39%
2015-2017	70.05%	11.11%	3.24%	15.60%
		Fixed housing		
2011-2013	47.06%	34.10%	1.78%	17.06%
2013-2015	56.78%	23.76%	0.52%	18.94%
2015-2017	64.00%	17.12%	1.97%	16.91%

One of the reasons capital gains on housing play the predominant role in generating volatility in wealth growth is because housing assets represent the largest component of individual investment portfolios. As shown in Table 6, housing assets account more than 70 percent of total households' assets.

So far we have shown that capital gains and, especially, capital gains on housing, are the main cause of cross-sectional variation in wealth growth. In the next section we use regression analysis to examine which aspects of housing affect wealth growth. In particular, we explore the role of 'newly purchased houses', 'pre-owned houses', and 'housing debt'.

Table 6: **The share of housing assets in total assets. Quitile sorting based on growth rate of wealth.**

	obs	$\frac{\text{hs-asset}}{\text{asset}}$	$\frac{\text{fin-asset}}{\text{asset}}$	$\frac{\text{bus-asset}}{\text{asset}}$	$\frac{\text{oth-asset}}{\text{asset}}$	$\frac{\text{t-debt}}{\text{asset}}$	$\frac{\text{hs-debt}}{\text{asset}}$
	Asset composition in 2015						
all	15,742	69.14%	13.23%	10.75%	6.88%	4.99%	2.97%
Quintile 1	3,111	59.16%	9.32%	23.62%	7.90%	4.47%	1.74%
Quintile 2	3,068	65.24%	14.65%	12.12%	7.98%	4.31%	1.95%
Quintile 3	2,969	71.05%	15.93%	6.90%	6.12%	3.68%	2.24%
Quintile 4	3,300	77.05%	13.39%	3.94%	5.62%	5.11%	3.66%
Quintile 5	3,294	77.03%	12.77%	3.62%	6.59%	9.23%	7.05%
	Asset composition in 2017						
all	15,742	75.48%	12.46%	5.62%	6.44%	6.24%	3.85%
Quintile 1	3,111	61.55%	16.83%	7.80%	13.82%	34.84%	11.57%
Quintile 2	3,068	72.87%	13.56%	5.60%	7.97%	6.17%	3.79%
Quintile 3	2,969	74.18%	12.98%	6.22%	6.62%	5.13%	3.57%
Quintile 4	3,300	78.58%	12.25%	3.80%	5.37%	4.10%	3.08%
Quintile 5	3,294	76.55%	11.29%	6.48%	5.68%	5.15%	3.72%

Notes: hs=housing; fin=financial; bus=business; oth=other; t=total.

1.5 Regression analysis

In this section, we provide more evidence about the determinants of wealth growth (mobility) using regression analysis. For simplicity we report only the results for the most recent survey years although they are robust to earlier surveys. We consider five dependent variables:

1. g_w: growth rate of wealth.

2. $P(g_w^{High})$: probability of being in the top 33% of wealth growth.

3. $P(g_w^{Low})$: probability of being in the bottom 33% of wealth growth.

4. $P(up)$: probability of moving out of the bottom 33% of wealth growth.

5. $P(down)$: probability of moving out of the top 33% of wealth growth.

We regress these variables on several indicators and the results are reported in Table (7). The first column of the table shows the results when the dependent variable is wealth growth. It shows that wealth growth is negatively correlated with initial wealth and positive correlated with savings. These correlations have intuitive interpretations: the initial wealth has a negative effect on growth due to 'reversal-to-the-mean' effect while savings raise next period wealth.

More importantly, we find that wealth growth is positively associated with housing. Wealth increases more if households has multiple houses, purchased new houses during the sample period or had houses with increasing housing prices. We use the term 'newly purchased houses' for households who purchased a house during the sample period and 'housing appreciation' for households who owned at least one house and whose house price increased more than 50% during the sample period. We also find that wealth growth is positively correlated with education and it has an inverse U-shape relation with age. Finally, owning a business is important for increasing the growth rate of wealth.

The housing variables and business ownership have positive effects on the probability of experiencing high growth of wealth (second column of Table 7) and moving to the upper group (fourth column of Table 7). The housing variables are also significant in explaining the probability of experiencing low growth but with the opposite sign. These results show that housing is an important factor for wealth mobility in China.

Table 7: **The impact of housing debt on wealth growth.**

	(1) g_w	(2) $P(g_w^{High})$	(3) $P(g_w^{Low})$	(4) $P(\text{up})$	(5) $P(\text{down})$
Lag wealth	-0.35***	-0.12***	0.06***	-0.10***	0.07***
	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)
Saving	0.55***	0.17***	-0.19***	0.11***	-0.02***
	(0.05)	(0.02)	(0.02)	(0.02)	(0.00)
Lag housing debt	**1.81*** **	**0.98*** **	**-0.58*** **	**0.48*** **	**-0.07*** **
	(0.19)	(0.09)	(0.08)	(0.08)	(0.03)
New purchased house	0.79***	0.31***	-0.18***	0.09***	-0.04***
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)
Housing appreciation	1.07***	0.52***	-0.33***	0.15***	-0.06***
	(0.03)	(0.01)	(0.01)	(0.01)	(0.00)
Multiple house owner	0.21***	0.04***	-0.13***	-0.04***	-0.06***
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)
Business owner	0.28***	0.08***	0.00	0.01	0.01
	(0.04)	(0.02)	(0.02)	(0.01)	(0.01)
Age	0.02***	0.01***	-0.01***	0.00	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age^2	-0.00***	-0.00***	0.00***	-0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
College	0.14***	0.05***	-0.08***	-0.00	-0.04***
	(0.03)	(0.01)	(0.01)	(0.01)	(0.01)
Family size	-0.02*	-0.01***	0.01***	-0.00	0.00
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	4.10***	1.56***	-0.14*	1.37***	-0.73***
	(0.20)	(0.08)	(0.09)	(0.07)	(0.04)
Observations	15,551	15,551	15,551	15,551	15,551
R-squared	0.38	0.36	0.17	0.17	0.11

Table 7) also shows that housing debt is important for mobility: households with higher debt experience higher growth, face higher probability of moving up and lower probability of moving down the distribution of wealth. These findings show that borrowing against housing assets could be an important way to enhance the likelihood to moving up in the distribution of wealth. But how many Chinese households borrow?

Table 8 shows that in 2017 only 16.4 percent of households in the sample had housing debt. Conditional on having housing debt, the average housing debt to asset ratio was 13.48%, and the average housing debt to income ratio was 193.22%. Similar statistics are found in other survey years. Therefore, even if debt could be important for mobility, only a small fraction of Chinese households borrow against housing assets. Furthermore, the value of debt for those who borrow is relatively small. This points out that the financial structure of China is still in a development stage. Limited borrowing may be considered an impediment to enhance mobility. From a macro perspective, however, less debt may provide greater financial and macroeconomic stability.

Table 8: **Summary statistics for housing debt, 2017.**

	Obs	**Mean**	**Std. Dev.**	**Min**	**Max**
	Whole sample				
HouseDebt/Income	15,523	25.23%	65.64%	0.00%	247.39%
TotalDebt/Income	15,523	50.65%	109.10%	0.00%	399.93%
HouseDebt/Asset	15,742	2.40%	6.08%	0.00%	22.04%
TotalDebt/Asset	15,742	5.86%	12.16%	0.00%	43.80%
	Positive housing debt				
HouseDebt/Income	2,539	141.67%	87.75%	0.00%	247.39%
TotalDebt/Income	2,539	193.22%	137.94%	0.00%	399.93%
HouseDebt/Asset	2,584	13.48%	7.62%	0.00%	22.04%
TotalDebt/Asset	2,584	19.93%	14.18%	0.00%	43.80%

2 The model

The economy is populated by a mass 1 of agents, each surviving with probability $1-\omega$. Exiting agents are replaced by the same number of newborn agents so that population stays constant over time. Expected lifetime utility is given by

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \ln(c_t),$$

where $c_t = \hat{c}_t + \chi h_t$ is total consumption, which is the sum of non-housing consumption, $\hat{c}_t$, and housing services χh_t (h_t is the stock of houses and χ is a constant parameter). In addition to housing services that enter directly the utility function, housing also generates income as specified below. The discount factor $\beta = \hat{\beta}\omega$ is the product of the inter-temporal discount factor $\hat{\beta}$ and the survival rate, ω. Newborn agents are endowed with the average states of surviving agents.

At each point in time agents are heterogeneous in earning ability l_t which evolves endogenously over time according to

$$l_{t+1} = \eta_t l_t + e_t.$$

The variable e_t is human capital investment and η_t is an idiosyncratic shock that increases or decreases the existing stock of human capital. Human capital earns the wage w_t as specified below.

We think of individual labor earnings as broadly defined. They include not only the typical wage income but also profits from small undiversified businesses. Therefore, human capital investment also includes investment in undiversified businesses.

The shock η_t is iid with $\mathbb{E}\eta_t = 1$. Even though the shock is iid, earnings are very persistent since the shock affects the stock of human capital. Modelling labor (and business) earnings as an endogenous process that depends on human capital investment is analytically convenient because allows us to keep agents' decision rules linear in wealth, which in turn allows for linear aggregation.

Agents can hold three types of real and financial assets: housing, h_t, stock market, k_t, and bonds, b_t. Housing is in limited supply and traded at an average price P_t. Housing is subject to both aggregate and idiosyncratic shocks we will describe shortly. The stock market represents the diversified ownership of business capital and it is subject to aggregate shocks only. We assume that business capital is reproducible without adjustment cost. This implies that its price is always 1. Bonds do not carry any risk and pay the gross return R_t. Bond holdings can be negative in which case the agent borrows. Borrowing, however, is limited by the collateral constraint

$$-b_{t+1} \leq \xi\Big(P_t h_{t+1} + \lambda k_{t+1} + l_{t+1}\Big). \qquad (5)$$

The collateral constraint depends on the value of owned houses, stock market and human capital. The latter is a proxy for labor income which is also taken into account by lenders when they screen loan applications. We also allow the stock market (business capital) to be used as a collateral. However, the collateral value of the stock market is likely to be lower than housing and labor income. In the calibration this will be captured by the parameter λ which will be smaller than 1.

The stock market generates the cash flow $r_t^k k_t$, where r_t^k depends on aggregate productivity as specified below. Each unit of houses generates the cash flow r_t^h, which also depends on aggregate productivity. In addition, houses are subject to idiosyncratic stochastic appreciation/depreciation ψ_t: h_t units of houses purchased in the previous period become $\psi_t h_t$ effective units this period. The stochastic variable ψ_t is iid with $\mathbb{E}\psi_t = 1$. We think of ψ_t as capturing idiosyncratic local factors that can increase or decrease the value of a housing unit relatively to the aggregate price P_t. The aggregate price P_t is determined in the general equilibrium through the interaction of aggregate demand and supply.

To capture the heterogeneous participation in riskier markets, we assume that agents face heterogeneous costs of investing in housing, stock market and human capital. More specifically, agents incur the cost $\tau_t(h_{t+1}P_t+k_{t+1}+l_{t+1})$. The term τ_t is an idiosyncratic stochastic variable that follows a finite first order Markov process. Agents with a lower value of τ_t, will participate more in the these markets. This implies that in equilibrium they will borrow from agents with higher values of τ_t. One of the goals of this paper is to explore how participation in high return markets impacts wealth distribution and mobility. We do that by changing the stochastic process for the cost τ_t, which can be interpreted as the result of financial markets development.

The budget constraint for an agent with investment cost τ_t is

$$c_t + (1+\tau_t)\Big[P_t h_{t+1} + k_{t+1} + l_{t+1}\Big] + b_{t+1} = R_t^h h_t + R_t^k k_t + R_t^l l_t + R_t b_t, \quad (6)$$

where R_t^h, R_t^k, R_t^l, R_t are the gross returns earned, respectively, on houses, stock market, human capital and bonds (or interest paid if b_t is negative). Since $c_t = \hat{c}_t + \chi h_t$ includes housing services that enter directly the utility function, the return on houses R_t^h also includes these services as we will see more explicitly below.

We now have all the elements to define the optimization problem solved by an individual household. Given $\mathbf{x}_t = (\tau_t, \psi_t, \eta_t)$ the vector of idiosyncratic shocks, the household's problem can be written as

$$V_t(\mathbf{x}_t; h_t, k_t, b_t) \quad = \quad \max_{\substack{c_t, h_{t+1}, \\ k_{t+1}, b_{t+1}}} \left\{ \ln(c_t) + \beta \mathbb{E}_t V_t(\mathbf{x}_{t+1}; h_{t+1}, k_{t+1}, b_{t+1}) \right\}, \quad (7)$$

subject to the borrowing constraint—equation (5)—and the budget constraint—equation (6). The subscript t in the value function captures the dependence on aggregate states. The housing price P_t and the returns R_t^h, R_t^k, R_t^l, R_t are all determined in the general equilibrium.

Production technology. There is a continuum of competitive firms that run the production function

$$Y_t = z_t H_t^{\theta_H} K_t^{\theta_K} L_t^{\theta_L},$$

where H_t is the input of houses, K_t is the input of capital, L_t is the input of labor and z_t is an aggregate productivity shock. The share parameters satisfy $\theta_H + \theta_K + \theta_L = 1$ (constant return to scale).

Capital is held in part by the government, denoted by $K_{g,t}$, and in part by the private sector, denoted by $K_{p,t}$. Therefore, $K_t = K_{g,t} + K_{p,t}$. Through the choice of $K_{g,t}$, the government affects the stock market assets that can be held by the private sector. Changes in government ownership of productive capital is one of the policies we will study in this paper.

The optimality conditions for the representative firm are

$$\begin{aligned} r_t^h &= \theta_H z_t H_t^{\theta_H - 1} K_t^{\theta_K} L_t^{\theta_L}, \\ r_t^k &= \theta_K z_t H_t^{\theta_H} K_t^{\theta_K - 1} L_t^{\theta_L}, \\ w_t &= \theta_L z_t H_t^{\theta_H} K_t^{\theta_K} L_t^{\theta_L - 1}, \end{aligned}$$

and the gross returns on housing, stock market and human capital are

$$\begin{aligned} R_t^h &= r_t^h + \chi + \psi_t P_t, \\ R_t^k &= r_t^k + 1 - \delta, \\ R_t^l &= w_t + \eta_t. \end{aligned}$$

While r_t^h, r_t^k and w_t are subject to the aggregate shock z_t, the gross returns R_t^h and R_t^l depend also, respectively, on the idiosyncratic shocks ψ_t and η_t. This formalizes the fact that investments in housing and human capital are less diversified than stock market investment. Small businesses, of course, are also very undiversified. However, we think of small businesses as being part of the process that determines earnings $w_t l_t$. Consistent with this interpretation, investment in human capital e_t also includes investments in small businesses.

The income earned by the government through the ownership of business capital is used to fund public consumption, G_t, and public investment, $K_{g,t+1} - (1-\delta)K_{g,t}$. The budget constraint for the government is

$$G_t + K_{g,t+1} = R_t^k K_{g,t}. \tag{8}$$

We assume that public consumption G_t generates benefits that are additive to the agents' utility from private consumption c_t. This implies that G_t does not affect agents' first order conditions and explains why we did not include it explicitly in the agents' utility function.

2.1 First order conditions and portfolio choices

The linearity of the investment portfolio, including the investment in human capital, is a convenient property that allows us to aggregate individual decisions for all agents with the same access to financial markets, that is, agents with the same value of τ_t.

Define the variable $a_t = R_t^h h_t + R_t^k k_t + R_t^l l_t + R_t b_t$. This is an 'extended' measure of household's net worth at the end of the period. It is an extended measure because it includes the household's human capital as well as the housing services, χh_t. Using the variable a_t and taking into account that the idiosyncratic shocks ψ_t and η_t are iid, we can rewrite the agent's problem as

$$V_t(\tau_t; a_t) = \max_{c_t, h_{t+1}, \tilde{k}_{t+1}, l_{t+1}, b_{t+1}} \Big\{ \ln(c_t) + \beta \mathbb{E}_t V_t(\tau_{t+1}; a_{t+1}) \Big\}, \tag{9}$$

subject to:

$$c_t = a_t - (1+\tau_t)\Big[P_t h_{t+1} + k_{t+1} + l_{t+1}\Big] - b_{t+1} \tag{10}$$

$$a_{t+1} = R_{t+1}^h h_{t+1} + R_{t+1}^k k_{t+1} + R_{t+1}^l l_{t+1} + R_{t+1} b_{t+1} \tag{11}$$

$$-b_{t+1} \leq \xi\Big(P_t h_{t+1} + \lambda k_{t+1} + l_{t+1}\Big). \tag{12}$$

The iid properties of ψ_{t+1} and η_{t+1} allow us to replace the vector of state variables $\mathbf{x}_t = (\tau_t, \psi_t, \eta_t)$ with only τ_t.

After normalizing the household's problem by a_t, we can rewrite it as

$$\tilde{V}_t(\tau_t) = \max_{\substack{\tilde{c}_t, \tilde{h}_{t+1}, \tilde{k}_{t+1}, \\ \tilde{l}_{t+1}, \tilde{b}_{t+1}}} \left\{ \log(\tilde{c}_t) + \beta \mathbb{E}_t \tilde{V}_{t+1}(\tau_{t+1}) + \frac{\beta}{1-\beta} \mathbb{E}_t \log(g_{t+1}) \right\}, \quad (13)$$

subject to:

$$\tilde{c}_t = 1 - (1+\tau_t)\Big[P_t \tilde{h}_{t+1} + \tilde{k}_{t+1} + \tilde{l}_{t+1}\Big] - \tilde{b}_{t+1} \quad (14)$$

$$g_{t+1} = R^h_{t+1}\tilde{h}_{t+1} + R^k_{t+1}\tilde{k}_{t+1} + R^l_{t+1}\tilde{l}_{t+1} + R_{t+1}\tilde{b}_{t+1} \quad (15)$$

$$-\tilde{b}_{t+1} \leq \xi\Big(P_t \tilde{h}_{t+1} + \lambda \tilde{k}_{t+1} + \tilde{l}_{t+1}\Big), \quad (16)$$

where, $V_t(\tau_t; a_t) = \log(a_t)/(1-\beta) + \tilde{V}_t(\tau_t)$ and $g_{t+1} = a_{t+1}/a_t$. All variables with a tilde sign are divided (normalized) by a_t. For example, $\tilde{c}_t = c_t/a_t$ and $\tilde{h}_{t+1} = h_{t+1}/a_t$. Notice that the law of motion for net worth now defines the growth rate of a_t which we indicated with g_{t+1}.

The first order conditions are

$$\tilde{h}_{t+1} : \frac{(1+\tau_t)P_t}{\tilde{c}_t} = \frac{\beta}{1-\beta}\mathbb{E}_t\left(\frac{R^h_{t+1}}{g_{t+1}}\right) + \mu_t \xi P_t, \quad (17)$$

$$\tilde{k}_{t+1} : \frac{1+\tau_t}{\tilde{c}_t} = \frac{\beta}{1-\beta}\mathbb{E}_t\left(\frac{R^k_{t+1}}{g_{t+1}}\right) + \mu_t \xi \lambda, \quad (18)$$

$$\tilde{l}_{t+1} : \frac{1+\tau_t}{\tilde{c}_t} = \frac{\beta}{1-\beta}\mathbb{E}_t\left(\frac{R^l_{t+1}}{g_{t+1}}\right) + \mu_t \xi, \quad (19)$$

$$\tilde{b}_{t+1} : \frac{1}{\tilde{c}_t} = \frac{\beta}{1-\beta}\mathbb{E}_t\left(\frac{R_{t+1}}{g_{t+1}}\right) + \mu_t, \quad (20)$$

where μ_t is the Lagrange multiplier associated with collateral constraint.

These conditions are exactly the same for all agents with the same value of the investment cost τ_t. They differs only among agents with different values of τ_t. Different values of the investment cost imply different (expected) returns on housing, stock market and human capital. Because of the heterogeneous expected returns, agents choose different composition of portfolio, that is, different values of $\tilde{h}_{t+1}$, $\tilde{k}_{t+1}$, $\tilde{l}_{t+1}$ and $\tilde{b}_{t+1}$. In particular, we will see that agents with higher investment cost τ_t choose positive values of $\tilde{b}_{t+1}$ and become lenders. Instead, agents with lower investment cost τ_t chose negative values of $\tilde{b}_{t+1}$ and become borrowers. For borrowing agents the collateral constraint could be binding or not binding. In the first case $\mu_t > 0$. In the second case $\mu_t = 0$. Differences in portfolio choices imply that agents experience different stochastic properties of wealth growth and, therefore, differences in wealth mobility.

If we multiply the first order conditions (22)-(26) by $\tilde{h}_{t+1}$, $\tilde{k}_{t+1}$, $\tilde{l}_{t+1}$, $\tilde{b}_{t+1}$, respectively, and we add them together, we obtain

$$\frac{1-\tilde{c}_t}{\tilde{c}_t} = \frac{\beta}{1-\beta}. \tag{21}$$

This implies that $\tilde{c}_t = 1-\beta$ or, equivalently, $c_t = (1-\beta)a_t$.

Defining $\tilde{\mu}_t = (1-\beta)\mu_t$ and substituting $\tilde{c}_t = 1-\beta$ in the first order conditions we obtain the following five equations,

$$(1+\tau_t)P_t = \beta\mathbb{E}\left(\frac{R^h_{t+1}}{g_{t+1}}\right) + \tilde{\mu}_t\xi P_t, \tag{22}$$

$$1+\tau_t = \beta\mathbb{E}\left(\frac{R^k_{t+1}}{g_{t+1}}\right) + \tilde{\mu}_t\xi\lambda, \tag{23}$$

$$1+\tau_t = \beta\mathbb{E}\left(\frac{R^l_{t+1}}{g_{t+1}}\right) + \tilde{\mu}_t\xi, \tag{24}$$

$$1 = \beta\mathbb{E}\left(\frac{R_{t+1}}{g_{t+1}}\right) + \tilde{\mu}_t, \tag{25}$$

$$\tilde{\mu}_t = 0, \qquad \text{if} \quad -\tilde{b}_{t+1} < \xi_t(P_t\tilde{h}_{t+1} + \lambda\tilde{k}_{t+1} + \tilde{l}_{t+1}), \tag{26}$$

where $g_{t+1} = R^h_{t+1}\tilde{h}_{t+1} + R^k_{t+1}\tilde{k}_{t+1} + R^l_{t+1}\tilde{l}_{t+1} + R_{t+1}\tilde{b}_{t+1}$. This provides a dynamics system of five first order difference equations in five variables: h_t, k_t, l_t, b_t, and mu_t. Given the aggregate states, and for each individual state τ_t, we can derive explicit solutions for $\tilde{h}_{t+1}$, $\tilde{k}_{t+1}$, $\tilde{l}_{t+1}$, $\tilde{b}_{t+1}$, and $\tilde{\mu}_t$. Beca use of the normalization, the solutions are independent of a_t.

2.2 General equilibrium and numerical solution

A key object that needs to be solved in general equilibrium is the housing price P_t. The housing price is a function of the aggregate states, which we denote by $\mathbf{s}_t$. Thus, we can express it as $P_t = \mathcal{P}(\mathbf{s}_t)$.

We assume that the idiosyncratic state τ_t takes I values. Therefore, at any point in time there are I groups or types of agents, each characterized by a particular realization of τ_t. Agents in each group differ in the endogenous states. However, to characterize the general equilibrium, we only need the aggregation of the endogenous states for each group, which we denote by H_t^i, K_t^i, L_t^i, B_t^i, with $i = 1, ..., I$. Even if an agent is in a group i today, it may be in a different group in the next period because τ_t changes stochastically. The sufficient set of aggregate states needed to solve for the equilibrium is $\mathbf{s}_t = \left\{z_t, \{H_t^i, K_t^i, L_t^i, B_t^i\}_{i=1}^I\right\}$.

We can reduce further the number of sufficient aggregate states by defining the variable

$$N_t^i = (r_t^h + \chi)H_t^i + R_t^k K_t^i + \bar{R}_t^l L_t^i + R_t B_t^i,$$

where $\bar{R}_t^l$ is the gross return on human capital averaged over the idiosyncratic shock η_t, that is, $\bar{R}_t^l = \int_\eta R_t^l f(\eta) d\eta$. The variable N_t^i is the i group aggregate net worth, including human capital, but with the exclusion of housing wealth $P_t H_t^i$. More specifically, N_t^i is equal to $A_t^i - P_t H_t^i$, where A_t^i is the aggregation of the extended net worth for group i. Using the variable N_t^i, the sufficient set of aggregate states are $\mathbf{s}_t = \left\{z_t, \{H_t^i, N_t^i\}_{i=1}^I\right\}$.

If we knew the price function $\mathcal{P}(\mathbf{s}_t)$, we could predict the next period price $P_{t+1} = \mathcal{P}(\mathbf{s}_{t+1})$ for each value of next period states $\mathbf{s}_{t+1}$. This would allow us to solve for the general equilibrium at any period t. However, since we do not know $\mathcal{P}(.)$, finding this function will be one of the objectives of the computational procedure to solve for the general equilibrium.

In order to make the numerical procedure operational, we need to approximate $\mathcal{P}(.)$ with a known functional form. We use the following approximation

$$P_{t+1} = \sum_j^{I^z} \alpha_z^j D_{t+1}^j + \sum_{i=1}^{I-1} \alpha_H^i H_{t+1}^i + \sum_{i=1}^{I} \alpha_N^i N_{t+1}^i$$

where D_{t+1}^j is the dummy variable for the j realization of aggregate productivity z_{t+1}. The numerical procedure will then solves for the coefficients α_z^j, α_H^i, α_N^i. Note that the summation for housing contains only $I-1$ terms because aggregate housing is constant in the model. The detailed numerical procedure is described in Appendix A

3 Quantitative analysis

The goal of the quantitative analysis is to use the calibrated model to conduct counterfactual exercises that allow us to address specific questions. In particular, how financial development in the form of greater access to credit and/or higher financial participation affect wealth distribution and mobility. We will also use the model to address the question of whether government ownership of capital has implications for wealth concentration and mobility. We start with the calibration of the model.

3.1 Calibration

Since the CHFS data is conducted every two years and some of the statistics that we use to calibrate the model require merging two consecutive surveys (for example, to compute the growth rate of individual wealth), the period in the model is two years.

The production function takes the form $Y_t = z_t H_t^{\theta_H} K_t^{\theta_K} L_t^{\theta_L}$ with share parameters $\theta_H = 0.15$, $\theta_K = 0.51$ and $\theta_L = 0.34$. The calibrated income share of housing, 15 percent, is higher than the number reported in the official Chinese statistics for the value added of rental income. However, the general view is that the official number underestimates the actual income generated by housing, which explains the higher number chosen for the calibration. After setting $\theta_H = 0.15$, the remaining fraction of income goes to capital and labor. The data suggests that, abstracting from housing, capital income accounts for about 60% and labor income for 40%. Therefore, we set $\theta^K = 0.85 \times 0.6 = 0.51$ and $\theta_L = 0.85 \times 0.4 = 0.34$. We consider the version of the model without aggregate shocks and normalize z_t to 0.5. The depreciation rate of capital over the two-year period is $\delta = 0.15$.

The model features three idiosyncratic shocks: ψ_t, η_t and τ_t. We assume that the first shock is iid and can take five different values with equal probability. We then use the cross-sectional distribution of housing price growth in the data to assign the five values. Using the 2013 and 2015 waves, we first compute the individual growth rate in housing price between 2013 and 2015. We then order households according to their individual growth rate and arrange them in quintiles. The five values of ψ are set using the deviation of the average growth rate of each quintile from the sample mean. More specifically, we set $\psi^i = 1 - (g^i - \sum_{i=1}^{5} g^i)$, where g^i is the growth rate for decile $i = 1, ...5$. We do the same for the 2015-2017 waves and then we average the values of ψ^i over 2013-2015 and 2015-2017.

To calibrate the shock to human capital, η_t, we use the same procedure. We first construct quintiles for the growth rate of labor and business income, both for 2013-2015 and 2015-2017. Then, after calculating the deviation of growth from the sample mean of each quintile, we average over 2013-2015 and 2015-2017. The resulting numbers are reported in Table 9.

Table 9: **Distribution of housing price and labor earning growth**

	1st	2nd	3rd	4th	5th
Housing price growth (ψ)	0.568	0.875	0.963	1.076	1.516
Labor earning growth (η)	0.568	0.875	0.963	1.076	1.516

The remaining idiosyncratic shock is the investment cost τ_t. We assume that τ_t follows a two-state first order Markov process. We further assume that the lower value, $\underline{\tau}$, is zero. This implies that in every period, a fraction of households can access high return investments without incurring any cost. After imposing these restrictions, we need to calibrate the high value, $\bar{\tau}$, and the transition probability matrix. Since in the model households with $\tau_t = \underline{\tau}$ borrow while households with $\tau_t = \bar{\tau}$ do not borrow, to calibrate the transition probabilities for the shock we use the empirical two-year individual transitions from borrowers (positive housing debt) to not borrowers (zero housing debt). The empirical two-year transition matrix, averaged over 2013-2015 and 2015-2017, is reported in Table 10. The transition matrix implies that the steady state fraction of agents with low cost is about 15 percent.

Table 10: **Two-year transition matrix** $\Gamma(\tau_t, \tau_{t+1})$

	Borrowing	Not Borrowing
Borrowing	0.52	0.48
Not borrowing	0.08	0.92

To calibrate the last parameter pertaining to the investment cost, $\bar{\tau}$, we use conditions (24) and (26). Agents with $\tau_t = \bar{\tau}$ do not borrow. Therefore, $\tilde{\mu}_t = 0$. Since we are considering the steady state without aggregate shocks,

R^k_{t+1} is not stochastic. Conditions (24) and (26) then imply that

$$1 + \bar{\tau} = \frac{R^k_{t+1}}{R_{t+1}}.$$

Thus, $\bar{\tau}$ is directly related to the spread between the average return on the stock market, R^k_{t+1}, and the interest rate, R_{t+1}, which we set to 14% for the bi-annual period.

At this point we are left with five parameters: the utility from owning houses, χ, the collateral parameters, ξ and λ, the discount factor $\hat{\beta}$ and the death probability ω (remember that $\beta = \omega\hat{\beta}$). In addition, we need to fix the stock of physical capital held by the government. For the parameter λ, however, we do not have direct evidence that allows us to pin down its precise value. So we simply set it to 0.5. This means that the collateral value of the stock market is 50% lower than the collateral value of houses. After that, we calibrate the remaining four parameters and the capital held by the government jointly to match the following targets: (i) the share of housing in households' portfolio is 75%; (ii) the aggregate debt over (two-year) output is 15%; (iii) the two-year interest rate is 6% ($R_{t+1} = 1.06$); (iv) the stock of capital held by the government is 50%; (v) the Gini index for wealth is 0.7. These calibration targets are taken from the data. The full set of parameter values are reported in the top section of Table 11 while the bottom section reports some steady state statistics.

3.2 Steady state statistics

Most of the statistics reported at the bottom section of Table 11 are calibration targets. For example, we impose that the model generates a wealth Gini of 0.7. The other distributional statistics, however, are not targeted in the calibration. In particular, in the last row of the table we can see that the share of wealth held by the top 1 percent of households is 27.7%. This is higher than the share computed from the CHFS. We would like to point out, though, that the CHFS survey misses the super wealthy in China. Accounting for them may increase the concentration statistics at the very top of the distribution.

One dimension of interest is the participation in investment markets which is determined by the cost τ_t. This cost follows a two-state Markov process. At any point in time about 85% of households face the high cost $\bar{\tau}$ while the

Table 11: **Calibration and steady state statistics**

Calibration value	
Discount factor	$\beta = 0.8985$
Death probability	$\omega = 0.0116$
Utility from housing	$\chi = 0.028$
Aggregate productivity	$\bar{z} = 0.5$
Income shares	$\theta_H = 0.15$, $\theta_K = 0.51$, $\theta_L = 0.34$
Capital depreciation	$\delta = 0.15$
Collateral parameter	$\xi = 0.176$
Collateral on k	$\lambda = 0.5$
Investment cost	$\tau_t \in \Big\{0, 0.1321\Big\}$, $\Gamma(\tau_t, \tau_{t+1}) = \begin{bmatrix} 0.92 & 0.08 \\ 0.48 & 0.52 \end{bmatrix}$
Housing shocks	$\psi_t \in \Big\{0.5686, 0.8756, 0.9636, 1.0761, 1.5161\Big\}$
Labor earning shocks	$\eta_t \in \Big\{0.4544, 0.8534, 1.0114, 1.1704, 1.5104\Big\}$
Steady state statistics	
House price	0.172
Output	0.082
Debt-Output ratio	0.151
Privately owned capital	0.060
Publicly owned capital	0.060
Housing share in wealth	0.695
Return on bonds	0.060 (3% annually)
Return on stock market	0.199 (10% annually)
Wealth Gini	0.699
Top percentiles of wealth	0.458 (top 5%), 0.277 (top 1%), 0.135 (top 0.1%)

remaining 15% face the low cost $\underline{\tau} = 0$. This cost determines the portfolio choice made by households and, given these choices, their wealth mobility. The portfolio choices and mobility are shown in Table 12.

As can be seen, agents with low investment cost allocate a larger fraction of their wealth in housing, stock market and human capital. Their bond ownership is negative meaning that they borrow from agents with high investment costs. As a result of allocating a larger share of wealth in high return assets (housing, stock market and human capital), the average growth rate of wealth of low cost households is much higher than for high cost households. In fact, for high cost households the expected growth rate of wealth is slightly negative. At the same time, because low cost households allocate a larger faction of their wealth in high volatile assets (housing and human capital), they experience greater standard deviation of growth. Thus, low cost households

Table 12: **Portfolio composition and property of wealth growth**

	Portfolio composition				Wealth Stats	
	Housing	*Stock market*	*Human capital*	*Bonds*	*Mean growth*	*St. Dev. growth*
High cost, $\bar{\tau}$	0.462	0.170	0.324	0.044	-0.011	0.157
Low cost, $\underline{\tau}$	0.600	0.181	0.419	-0.200	0.098	0.243

are characterized by higher upward mobility (on average they experience a higher rate of wealth growth) and higher overall volatility of growth (up and down).

The cost τ_t is just a simple way of capturing participation in investment markets. The numbers reported in Table 12 suggest that participation in these markets is an important mechanism for understanding wealth mobility. In the next section we explore this point further.

3.3 Structural changes

We consider several changes that could emerge as a result of financial development or policies. The first change allows for greater access to credit, which in the model is captured by a higher value of the collateral parameter ξ. The second change allows for greater access or participation in investment markets. There are two ways in which we could generate higher participation in the model: by reducing the high investment cost $\bar{\tau}$ and/or by decreasing the number of households that face the high cost $\bar{\tau}$. The third change is the reduction in government ownership of productive capital, K_g.

Higher access to credit. Higher access to credit is obtained by increasing the collateral parameter ξ. In particular, we increase ξ so that debt over output doubles in the new steady state—from 15% to 30%. The results are reported in Table 13

A credit expansion has both aggregate and distributional effects. It leads to an increase in aggregate production due to higher investment from low-cost households. These households can now finance with debt larger investments in housing, stock market and human capital. As a result, more savings are invested in reproducible factors (physical and human capital), which has a

Table 13: **Higher access to credit**

	Baseline calibration			*Higher ξ*		
House price	0.172			0.180		
Output	0.082			0.088		
Debt-Output ratio	0.151			0.302		
Private capital	0.060			0.070		
Public capital	0.060			0.060		
Housing share	0.695			0.635		
Return on bonds	0.060			0.057		
Return on stocks	0.199			0.195		
Wealth distribution	Gini	0.699		Gini	0.715	
	Top 5%	0.458		Top 5%	0.481	
	Top 1%	0.277		Top 1%	0.301	
	Top 0.1%	0.135		Top 0.1%	0.153	
Portfolio composition	Housing	0.462,	0.600	Housing	0.422,	0.677
	Stocks	0.170,	0.181	Stocks	0.176,	0.225
	Human	0.324,	0.419	Human	0.312,	0.486
	Bonds	0.044,	−0.200	Bonds	0.091,	−0.388
Wealth mobility	Growth	−0.011,	0.098	Growth	−0.009,	0.086
	St. Dev.	0.157,	0.243	St. Dev.	0.143,	0.287

positive impact on aggregate production. Low-cost households also invest more in housing. However, since the aggregate supply of houses is fixed, the higher investment in housing increases their market price. However, since physical capital increases more than the price of houses, the share of housing in households wealth declines.

We look now at the composition of portfolio for low and high cost households. Remember that about 85% of households face the high cost $\bar{\tau}$ while the remaining 15% face the low cost $\underline{\tau} = 0$. The portfolio of low-cost households contains a larger share of high return assets (housing, stock market and human capital), in part funded by debt purchased by high-cost households. The portfolio composition of the two types of households is important for the overall distribution of wealth and mobility. Higher access to credit, induced by the higher value of ξ, makes the differences in portfolio composition between low-cost and high-cost households even bigger. As a result of this change, the distribution of wealth becomes more concentrated. For example, the share held by the top 1% increases from 0.277 to 0.301. This follows from the fact that low-cost households now hold a more leveraged portfolio which allow them to experience higher mean growth as well as higher volatility of growth. On the other hand, high-cost households hold a larger share of safer assets (the debt issued by low-cost households). Consequently, they experience lower volatility of growth.

In summary, a credit expansion has a positive macroeconomic impact but it also makes the overall distribution of wealth more concentrated. It also increases the mobility differences between low and high-cost households: higher mobility for the low-cost households but lower mobility for high cost households.

Financial participation. Higher participation in high return markets can be generated in the model in two ways. The first is the reduction in the high investment cost $\bar{\tau}$. The second is the reduction in the fraction of households that face the high cost $\bar{\tau}$. The first change induces more participation through the intensive margin, that is, high-cost households now allocate a larger fraction of their wealth in high return assets. The second change generates more participation in the extensive margin, that is, more households hold portfolios with a larger shares of high return assets. Both of these changes can be seen as the result of financial development. Perhaps, through policy reforms.

We start with the reduction in the investment cost τ_t. We should emphasize that the investment cost should be interpreted broadly. Besides actual transaction costs in financial markets, it could capture lack of information or just aversion to more complex investment operations due, also, to lack of information. In the exercise conducted here we reduce $\bar{\tau}$ to half. The results are reported in Table 14.

The reduction in investment cost induces a large increase in aggregate output. Effectively, the reduction in $\bar{\tau}$ increases the effective return from investing in physical and human capital for high-cost households. This leads to higher savings. In the general equilibrium, the returns from physical and human capital will decline since the higher inputs of physical and human capital reduce their marginal products. However, the sensitivity of the marginal product to the supply is relatively low since physical and human capital account for 85 percent of the production inputs ($\theta_K + \theta_L = 0.85$). This implies that the reductions in the marginal products are associated with large in-

Table 14: **Lower investment cost**

			Baseline calibration				*Lower $\bar{\tau}$*	
House price			0.172				0.355	
Output			0.082				0.226	
Debt-Output ratio			0.151				0.141	
Private capital			0.060				0.325	
Public capital			0.060				0.060	
Housing share			0.695				0.496	
Return on bonds			0.060				0.078	
Return on stocks			0.199				0.150	
Wealth distribution	Gini	0.699			Gini	0.613		
	Top 5%	0.458			Top 5%	0.366		
	Top 1%	0.277			Top 1%	0.196		
	Top 0.1%	0.135			Top 0.1%	0.080		
Portfolio composition	Housing	0.462,	0.600		Housing	0.315,	0.380	
	Stocks	0.170,	0.181		Stocks	0.282,	0.390	
	Human	0.324,	0.419		Human	0.367,	0.414	
	Bonds	0.044,	−0.200		Bonds	0.035,	−0.184	
Wealth mobility	Growth	−0.011,	0.098		Growth	−0.003,	0.048	
	St. Dev.	0.157,	0.243		St. Dev.	0.121,	0.160	

creases in the supplies of physical and human capital, which in turn generate a large increase in aggregate production.

Since the supply of houses is fixed, the large increases in physical and human capital lead to a sizable increase in the marginal product of houses, which in turn generates a large rise in their price. The large increase in production and housing price would be smaller if the share of reproducible factors in the production function was lower. For example, if human capital was not reproducible. In this case the share of reproducible factors would be $\theta_K = 0.51$ instead of $\theta_K + \theta_L = 0.85$.

Perhaps more interesting are the distributional and mobility consequences, which is the main focus of this paper. We can see that the distribution of wealth becomes much less concentrated. For example, the share of wealth held by the top 1% declines from 0.277 to 0.196. This follows from the fact that the portfolios compositions of low-cost and high-cost households become more similar. As a result, we can also see that mobility, captured by the volatility of growth, decreases for both low and high-cost households.

To summarize, greater financial market participation induced by lower investment cost (intensive participation margin) has a positive effect on the aggregate economy. At the same time, it also leads to a more equal distribution of wealth thanks to more balanced mobility.

The second way to enhance participation is through the increase the number of households that face the low investment cost (extensive participation margin). We can generate this in the model by changing the structure of the transition matrix that governs the stochastic properties of τ_t.

The baseline calibration of the transition matrix leads to about 85% of the population with high investment cost and 15% with no cost. In the new calibration we choose a symmetric transition matrix so that in in the steady state 50% of households face high cost and 50% no cost. More specifically we change $\Gamma(\bar{\tau}, \bar{\tau})$ from 0.92 to 0.52, which is also the number for $\Gamma(\underline{\tau}, \underline{\tau})$. The results are reported in Table 15

Table 15: **Greater participation**

		Baseline calibration			*Lower* $\Gamma(\bar{\tau}, \bar{\tau})$	
House price		0.172			0.383	
Output		0.082			0.240	
Debt-Output ratio		0.151			0.481	
Private capital		0.060			0.348	
Public capital		0.060			0.060	
Housing share		0.695			0.438	
Return on bonds		0.060			0.014	
Return on stocks		0.199			0.150	
Wealth distribution	Gini	0.699		Gini	0.649	
	Top 5%	0.458		Top 5%	0.400	
	Top 1%	0.277		Top 1%	0.224	
	Top 0.1%	0.135		Top 0.1%	0.098	
Portfolio composition	Housing	0.462,	0.600	Housing	0.256,	0.377
	Stocks	0.170,	0.181	Stocks	0.195,	0.386
	Human	0.324,	0.419	Human	0.333,	0.422
	Bonds	0.044,	−0.200	Bonds	0.216,	−0.185
Wealth mobility	Growth	−0.011,	0.098	Growth	−0.024,	0.032
	St. Dev.	0.157,	0.243	St. Dev.	0.093,	0.156

The impact of having a larger number of households facing low investment costs is similar to lowering $\bar{\tau}$. The macroeconomic impact is positive and large for the same reasons we described above for the case of a lower value $\bar{\tau}$. The distribution of wealth becomes less concentrated as a result of the fact that now the average growth of wealth experienced by the two groups of households is more similar and the standard deviation of growth decreases for both household types. Therefore, also in this case we conclude that greater participation is beneficial for the aggregate economy and brings more equality.

Privatization. A large share of Chinese businesses are owned by the government. What would be the consequences of privatizing state-owned businesses? To answer this question we compare the steady state equilibrium in the baseline calibration where half of the physical capital is held by the public sector, with the steady state equilibrium in which physical capital is held only by the private sector. The results are reported in Table 16.

From a macro prospective, privatization has negative consequences because it reduces aggregate production. This is intuitive: to induce the private sector to hold more capital, its return must increase. Since the return from capital is determined by its marginal product, the aggregate stock of capital must decline. This, in turn, reduces the marginal product of housing and human capital, which lead to a decline in both the price of houses and investment in human capital.

While the consequences for the aggregate economy are negative, privatization leads to a more equal distribution of wealth. One of the reasons is that the composition of household portfolios changes: households hold a smaller share of housing and a larger share of the stock market. In fact, the share of housing declines from 70 percent before privatization to 57 percent. When the government owns a large share of physical capital, it creates shortage of stock market assets that can be acquired by households. In equilibrium, then, households will hold more houses relatively to other assets. Since houses are risky, the growth rate of wealth is also more volatile, which generates more concentration of wealth.

To summarize, privatization may have a negative impact on aggregate economic activity. However, it allows for more diversified portfolios which lead to lower volatility in individual wealth growth. This, in turn, results in a more equal distribution of wealth.

Table 16: **Full privatization**

	Baseline calibration			*No public capital*		
House price	0.172			0.165		
Output	0.082			0.075		
Debt-Output ratio	0.151			0.172		
Private capital	0.060			0.107		
Public capital	0.060			0.000		
Housing share	0.695			0.571		
Return on bonds	0.060			0.067		
Return on stocks	0.199			0.207		
Wealth distribution	Gini	0.699		Gini	0.654	
	Top 5%	0.458		Top 5%	0.413	
	Top 1%	0.277		Top 1%	0.238	
	Top 0.1%	0.135		Top 0.1%	0.108	
Portfolio composition	Housing	0.462,	0.600	Housing	0.406,	0.545
	Stocks	0.170,	0.181	Stocks	0.284,	0.283
	Human	0.324,	0.419	Human	0.268,	0.364
	Bonds	0.044,	−0.200	Bonds	0.043,	−0.192
Wealth mobility	Growth	−0.011,	0.098	Growth	−0.014,	0.092
	St. Dev.	0.157,	0.243	St. Dev.	0.129,	0.206

4 Conclusion

We have explored the properties of individual wealth growth and mobility in China using the China Household Finance Survey (CHFS). There are three main findings. First, savings play a relatively minor role in explaining individual wealth mobility. Although households with higher rates of savings experience higher growth rate of wealth, heterogeneity in saving growth across households explains only a small portion of wealth growth heterogeneity. Instead, the most important factor is the heterogeneity of capital gains on asset holdings. This indicates that individual wealth in China is very undiversified.

The second finding is that housing wealth plays an important role in generating wealth mobility. This derives from two features of the Chinese economy. First, housing represents the largest component of households' wealth. Second, there is significant cross-sectional dispersion in capital gains on houses. These two facts further indicate that households' wealth is very undiversified in China and, therefore, households portfolios are exposed to large idiosyncratic risks.

The third finding is that households' debt increases wealth mobility. Households that hold more debt (higher leverage) tend to experience greater volatility of wealth growth.

These findings raise important questions. If housing ownership is so risky, why do Chinese households allocate such a large fraction of their portfolio in housing assets? If housing debt could enhance mobility, should borrowing be encouraged?

To address these questions, in the second part of the paper we built a general equilibrium model with heterogeneous agents where households choose three types of assets: housing, stock market investment and bonds (or debt when negative). An important form of heterogeneity if ability to participate in investment markets. After calibrating the model to the Chinese economy, we conduct several experiments. We first relax the financial constraints faced by households. We then allow for greater participation in investment markets and finally we consider a privatization of all Chinese businesses. The quantitative results show that greater access to credit and higher participation have positive effects on aggregate production. However, while the expansion of credit makes the distribution of wealth more concentrated and reduces mobility for households with lower access to investment markets, higher participation leads to a more equal distribution of wealth. Finally, we find that privatization is not necessarily beneficial for the aggregate economy but could lead to a more equal distribution of wealth.

While some of the changes considered in these experiments could be the natural consequence of financial development—as financial markets become more sophisticated, credit and investment markets become more accessible to the wider society—they could also be encouraged by policies. This is certainly the case for privatization. The fact that certain changes may have different effects on aggregate outcomes and distribution, implies that certain changes are more desirable than others.

A Numerical procedure

The numerical procedure consists of three steps:

1. Guess the values of the coefficients for the price function α_z^j, α_H^i, α_N^i.

2. Solve for the general equilibrium at any period $t = 1, ..., T$. This is done through these steps:

   (a) Given the states z_t, H_t^i and N_t^i, for $i = 1, ..., I$, we guess the equilibrium prices P_t, R_{t+1} and the normalized individual decisions $\tilde{h}_{t+1}^i$, $\tilde{k}_{t+1}^i$, $\tilde{l}_{t+1}^i$, $\tilde{b}_{t+1}^i$ for each group i. Since the individual decisions are normalized by net worth a_t^i, they are the same for all agents belonging to the same group i (that is, same τ_t).

   (b) Using the states H_t^i, N_t^i and the guessed price P_t, we compute the net worth for each group i,

   $$A_t^i = P_t H_t^i + N_t^i.$$

   This allows us to compute the aggregate next period variables

   $$\begin{aligned} H_{t+1}^j &= \sum_i \left(\tilde{h}_{t+1}^i A_t^i\right) \Gamma_{ij} \\ K_{t+1}^j &= \sum_i \left(\tilde{k}_{t+1}^i A_t^i\right) \Gamma_{ij} \\ L_{t+1}^j &= \sum_i \left(\tilde{l}_{t+1}^i A_t^i\right) \Gamma_{ij} \\ B_{t+1}^j &= \sum_i \left(\tilde{b}_{t+1}^i A_t^i\right) \Gamma_{ij}. \end{aligned}$$

   The term Γ_{ij} is the transition probability for τ_t.

   (c) We now compute the aggregate values of the production inputs in the next period,

   $$\begin{aligned} H_{t+1} &= \sum_j H_{t+1}^j \\ K_{t+1} &= \sum_j K_{t+1}^j \\ L_{t+1} &= \sum_j L_{t+1}^j, \end{aligned}$$

which in turn allows us to compute the next period returns for each realization of the aggregate shock z_{t+1},

$$\begin{aligned} r^h_{t+1} &= \theta_H z_{t+1} \bar{H}^{\theta_H - 1} K^{\theta_K}_{t+1} L^{\theta_L}_{t+1}, \\ R^k_{t+1} &= \theta_K z_{t+1} H^{\theta_H}_{t+1} K^{\theta_K - 1}_{t+1} L^{\theta_L}_{t+1} + 1 - \delta, \\ \bar{R}^l_{t+1} &= \theta_L z_{t+1} H^{\theta_H}_{t+1} K^{\theta_K}_{t+1} L^{\theta_L - 1}_{t+1} + \bar{\eta}. \end{aligned}$$

(d) Now we have all the ingredients to compute the next period state N^j_{t+1} for each group j,

$$N^j_{t+1} = r^h_{t+1} H^j_{t+1} + R^k_{t+1} K^j_{t+1} + \bar{R}^l_{t+1} L^j_{t+1}.$$

We now use N^j_{t+1} with the guessed price function for housing to compute the next period price for each realization of z_{t+1}, that is,

$$P_{t+1} = \sum_j^{I^z} \alpha^j_z D^j_{t+1} + \sum_{i=1}^{I-1} \alpha^i_H H^i_{t+1} + \sum_{i=1}^{I} \alpha^i_N N^i_{t+1}.$$

(e) At this point we have to check the accuracy of the initial guesses for the individual decisions and the prices P_t and R_t we made in step 2a. We do so by verifying

- The first order conditions for individual decisions for each $i = 1, ..., I$.
- The clearing conditions in the market for housing, $\sum_i^I H^i_{t+1} = 1$, and in the market for bonds, $\sum_i B^i_{t+1} = 0$.

These conditions are used to update the initial guesses and restart the procedure from step 2b until the approximation error is sufficiently small. In the actual code these steps are embedded by solving a system of equation using a nonlinear solver.

3. Using the solutions for $t = 1, ..., T$, we estimate the parameters of the price function by regression using the data generated for the T periods. The estimated parameters are then used to update the parameters of the price function.

B Additional Tables and Figures

Table 17: **Wealth mobility matrices for whole sample and sub-samples with housing debt and multiple houses. Linked surveys 2011-2013 and 2013-2015.**

Whole sample (2011-2013)			
	Bottom	Middle	Top
Bottom	74.3%	24.4%	1.3%
Middel	20.8%	55.8%	23.4%
Top	5.1%	11.4%	83.6%

With housing debt (2011-2013)			
	Bottom	Middle	Top
Bottom	61.9%	37.7%	0.4%
Middle	21.7%	45.5%	32.8%
Top	0.8%	10.9%	88.3%

With multiple houses (2011-2013)			
	Bottom	Middle	Top
Bottom	65.5%	34.5%	0.0%
Middle	17.7%	56.6%	25.7%
Top	3.0%	11.2%	85.8%

Whole sample (2013-2015)			
	Bottom	Middle	Top
Bottom	78.7%	18.5%	2.8%
Middel	29.1%	53.8%	17.2%
Top	6.1%	19.0%	75.0%

With housing debt (2013-2015)			
	Bottom	Middle	Top
Bottom	75.7%	21.2%	3.1%
Middle	29.4%	50.8%	19.8%
Top	5.2%	17.8%	77.0%

With multiple houses, (2013-2015)			
	Bottom	Middle	Top
Bottom	77.3%	18.0%	4.7%
Middle	27.4%	56.8%	15.8%
Top	3.9%	16.1%	80.0%

Table 18: **Household Characteristics (1)**

	obs	wealth at t	wealth at $t+1$	income at t	income at $t+1$	consum at t	consum at $t+1$	debt at $t+1$	debt at $t+1$
					2015-2017				
All	15,742	890,997	1,013,665	73,100	89,225	58,144	60,188	36,686	49,268
q1	3,111	915,890	182,634	59,240	55,337	52,850	45,499	33,683	45,398
q2	3,068	1,010,162	700,397	76,971	79,975	59,772	56,967	30,134	37,999
q3	2,969	974,514	1,054,948	81,521	95,537	60,233	63,399	31,987	39,323
q4	3,300	963,200	1,445,491	79,184	105,007	61,387	66,399	40,103	54,123
q5	3,294	591,226	1,684,440	68,585	110,261	56,479	68,675	47,514	69,487

Note: sorted by the growth rate of wealth

Table 19: **Household Characteristics (2)**

	obs	age	2-home owner	1-home owner	entrepr-eneur	college	tier-1 cities	house price rider	house buyer
					2015-2017				
All	15,742	50.57	21.06%	71.82%	9.16%	12.89%	8.99%	17.30%	15.57%
q1	3,111	53.06	7.82%	70.40%	8.51%	6.26%	7.94%	2.54%	6.84%
q2	3,068	50.68	16.35%	79.92%	9.92%	11.05%	5.27%	3.94%	8.84%
q3	2,969	50.80	21.81%	75.60%	8.96%	15.31%	6.84%	7.21%	10.79%
q4	3,300	49.65	26.86%	69.90%	8.20%	16.08%	12.19%	27.17%	17.22%
q5	3,294	48.64	32.47%	63.31%	10.21%	15.73%	12.70%	45.62%	34.13%

Note: sorted by the growth rate of wealth
Dummy variables at time $t+1$: 2-home owners, 1-home owners, entrepreneurship, college, tier-1 cities, house price riders, house buyers.

Table 20: **Wealth growth, sorting by the demographics**

	obs	g_{wt}	g_t	s_t	r_{wt}	r_{lt}	r_{kt}
				2013-2015			
Marriage status							
Single	2,234	8.2%	4.8%	19.4%	17.1%	8.2%	8.9%
Married	10,617	12.6%	7.3%	27.9%	19.0%	9.2%	9.8%
Education level							
Secondary and below	6,005	4.6%	2.2%	13.7%	17.6%	7.1%	10.5%
High school and equivalent	4,846	12.4%	7.2%	27.8%	18.7%	9.0%	9.7%
Bachelor and above	1,965	19.6%	11.7%	39.1%	20.2%	11.5%	8.8%
Age group							
Below 25	473	10.1%	7.4%	15.7%	17.4%	10.3%	7.0%
25-34	2,361	17.3%	10.2%	31.3%	22.6%	13.0%	9.5%
35-44	3,072	15.2%	9.8%	26.1%	20.8%	11.8%	9.1%
45-54	2,916	12.5%	8.0%	25.2%	18.0%	9.9%	8.1%
55-64	2,006	5.1%	1.3%	25.6%	14.7%	4.9%	9.9%
65 and above	2,023	5.7%	1.3%	27.6%	15.6%	0.9%	14.7%
				2015-2017			
Marriage status							
Single	2,862	3.9%	-1.1%	29.4%	17.2%	8.1%	9.1%
Married	12,880	13.4%	7.2%	31.7%	19.6%	9.4%	10.1%
Education level							
Secondary and below	7,984	4.2%	0.6%	19.4%	18.1%	7.6%	10.6%
High school and equivalent	5,567	11.7%	5.5%	32.9%	18.8%	8.8%	10.0%
Bachelor and above	2,185	26.1%	16.0%	45.9%	21.9%	12.9%	9.0%
Age group							
Below 25	330	-10.8%	-18.3%	37.7%	19.9%	11.9%	8.0%
25-34	2,356	17.7%	8.3%	39.1%	24.1%	14.6%	9.5%
35-44	3,249	19.8%	13.0%	30.8%	22.1%	12.2%	10.0%
45-54	3,782	12.5%	6.7%	30.3%	18.9%	10.8%	8.1%
55-64	2,798	8.2%	3.7%	28.0%	16.2%	6.0%	10.1%
65 and above	3,227	2.4%	-1.5%	26.9%	14.5%	1.0%	13.5%

Table 21: **Wealth growth across households (by initial wealth).**

	obs	g_{wt}	g_t	s_t	r_{wt}	r_{lt}	r_{kt}
				2011-2013			
All	3,705	19.4%	14.4%	26.8%	18.9%	11.9%	7.0%
q1	682	95.1%	80.3%	11.9%	124.2%	81.2%	43.0%
q2	701	74.8%	64.3%	19.9%	53.0%	35.0%	17.9%
q3	755	52.1%	44.8%	21.9%	33.7%	22.3%	11.4%
q4	827	42.7%	35.7%	28.7%	24.3%	14.0%	10.3%
q5	740	2.2%	-1.3%	34.7%	10.2%	6.4%	3.8%
				2013-2015			
All	12,851	11.8%	7.2%	24.8%	18.5%	11.5%	7.1%
q1	2,811	123.7%	116.5%	8.2%	88.0%	52.4%	35.6%
q2	2,425	52.3%	44.6%	19.1%	40.7%	25.2%	15.5%
q3	2,328	26.4%	20.0%	22.2%	29.1%	17.7%	11.3%
q4	2,393	20.3%	14.8%	26.9%	20.7%	12.6%	8.1%
q5	2,894	-2.8%	-6.2%	32.2%	10.6%	6.8%	3.8%
				2015-2017			
All	15,742	13.8%	8.0%	30.0%	19.1%	11.8%	7.3%
q1	3,134	83.8%	77.2%	7.6%	86.5%	51.9%	34.6%
q2	2,836	42.4%	32.3%	23.2%	43.1%	26.0%	17.1%
q3	2,837	23.3%	15.0%	27.3%	30.4%	18.9%	11.5%
q4	3,106	22.5%	15.6%	32.0%	21.5%	13.2%	8.3%
q5	3,829	3.5%	-0.9%	38.7%	11.3%	7.1%	4.2%

Table 22: **Wealth growth across households (by average wealth).**

	obs	g_{wt}	g_t	s_t	r_{wt}	r_{lt}	r_{kt}
			2011-2013				
All	3,705	19.4%	14.4%	26.8%	18.9%	11.9%	7.0%
q1	679	-9.5%	-16.2%	7.7%	88.0%	51.9%	36.1%
q2	701	18.5%	9.0%	20.5%	46.4%	32.3%	14.1%
q3	766	25.8%	19.8%	19.0%	31.9%	21.2%	10.7%
q4	837	26.0%	20.3%	25.4%	22.4%	13.8%	8.7%
q5	722	17.4%	13.1%	37.6%	11.4%	6.9%	4.5%
			2013-2015				
All	12,851	11.8%	7.2%	24.8%	18.5%	11.5%	7.1%
q1	2,840	-3.7%	-7.6%	5.9%	65.3%	40.2%	25.0%
q2	2,441	4.0%	-1.3%	15.7%	34.1%	21.0%	13.1%
q3	2,286	10.4%	4.0%	23.0%	27.4%	17.7%	9.7%
q4	2,377	12.6%	7.2%	26.1%	20.5%	12.5%	8.0%
q5	2,907	13.5%	9.6%	33.3%	11.6%	7.2%	4.5%
			2015-2017				
All	15,742	13.8%	8.0%	30.0%	19.1%	11.8%	7.3%
q1	3,106	-32.8%	-33.9%	1.8%	58.7%	33.5%	25.2%
q2	2,807	-12.8%	-20.2%	20.4%	36.2%	22.4%	13.9%
q3	2,856	0.2%	-7.2%	26.0%	28.4%	18.0%	10.4%
q4	3,117	8.3%	1.2%	32.9%	21.4%	13.4%	7.9%
q5	3,856	24.1%	19.1%	39.7%	12.4%	7.6%	4.8%

Table 23: **The growth rate of each asset component**

	obs	asset	hs-asset	fin-asset	bus-asset	oth-asset	debt	hs-debt
				2013-2015				
all	12,851	12.47%	12.78%	40.00%	48.07%	-25.80%	19.82%	16.05%
q1	2,749	-61.36%	-58.24%	-45.49%	-49.32%	-65.30%	39.18%	30.15%
q2	2,520	-15.85%	-12.90%	-6.74%	1.38%	-42.50%	10.31%	12.02%
q3	2,459	10.51%	10.20%	35.32%	19.61%	-21.59%	3.87%	1.06%
q4	2,542	46.79%	39.81%	98.12%	139.99%	1.80%	2.93%	-4.59%
q5	2,581	176.06%	173.29%	165.68%	305.80%	32.60%	47.55%	56.79%
				2015-2017				
all	15,742	14.83%	18.83%	17.38%	-31.07%	9.91%	34.30%	39.65%
q1	3,111	-75.00%	-77.54%	-51.10%	-77.97%	-49.81%	34.78%	31.53%
q2	3,068	-28.58%	-25.40%	-28.89%	-55.81%	-21.19%	26.10%	37.20%
q3	2,969	8.58%	10.62%	9.68%	-25.78%	12.68%	22.93%	28.77%
q4	3,300	49.47%	51.09%	49.63%	1.87%	43.43%	34.96%	35.90%
q5	3,294	173.50%	173.20%	127.19%	91.84%	97.66%	46.25%	54.17%

Note: sorted by the growth rate of wealth
Variables: total assets, house assets, financial assets, business assets, other assets, total debt, house debt.

Table 24: The way households obtained their houses (from 2017 survey)

	Freq.	Percent
1, purchased, new	5,680	24.95
2, purchased, second hand	3,102	13.62
3, purchased, policy housing	944	4.15
4, inherited	974	4.28
5, welfare housing	2,891	12.7
6, public funding housing	418	1.84
7, self-constructed	6,335	27.83
8, resettlement housing	1,884	8.28
9, purchased, limited property right	274	1.2
10, others	265	1.16
Total	22,767	100

Note: Type 1&2 are typical commercial housing, which has a fair market price. Type 7 are households who were previously rural households and now became urban households. The house price in Figure 2 are calculated based on Type 1&2 houses.

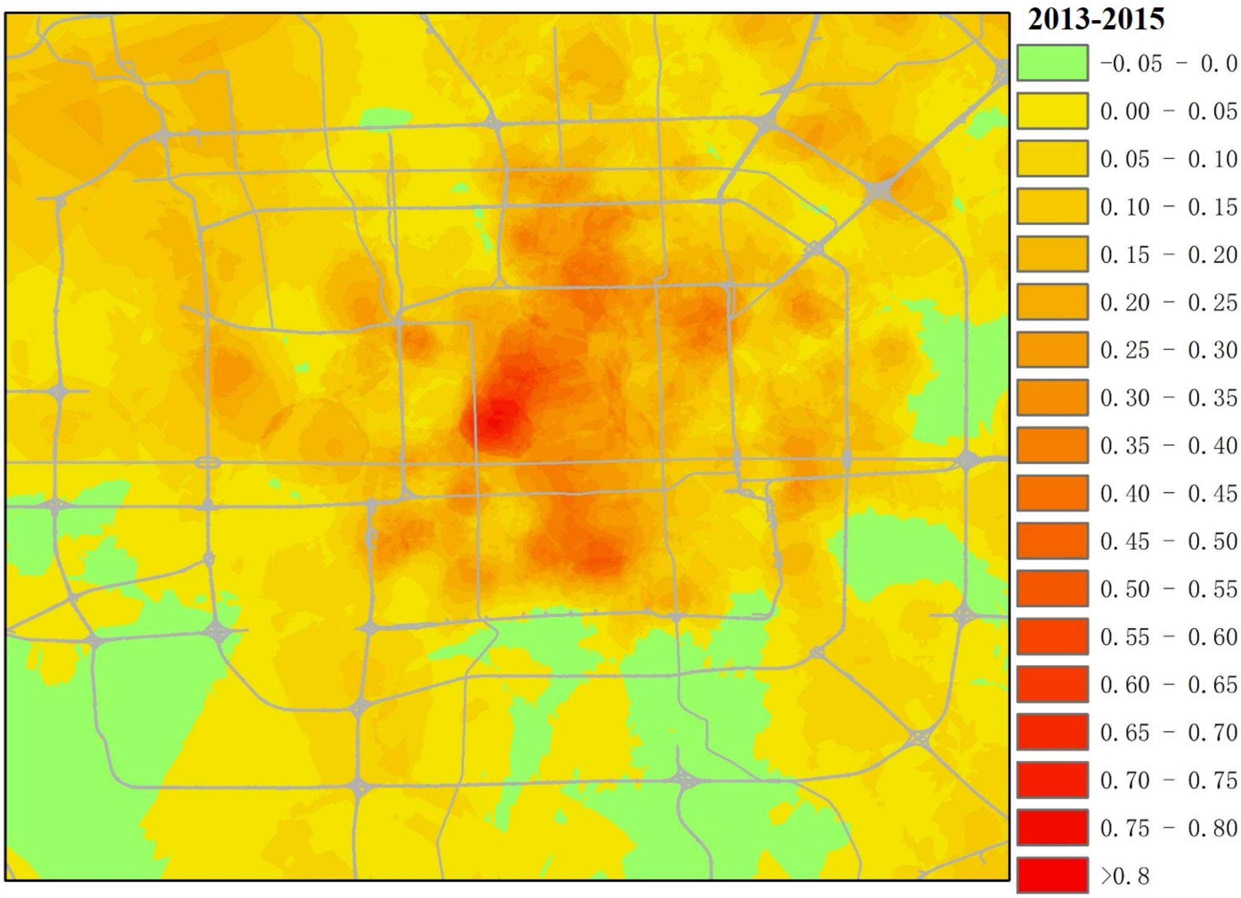

Figure 1: **Community level house price growth rate in Beijing (from transaction data of Lianjia)**

This figure presents the two-year housing price growth rate during the period 2013-2015 across communities in the city of Beijing. Warn color means positive growth rate, while green color represents negative growth. The grey circles represent the highways of Beijing. The data is from the largest real-estate brokerage company Lianjia (like Zillow in US). In 2015, there were around 70,000 housing transactions across 3,000 communities in Beijing. Based on the transaction data, we first calculate the average housing price for each community and then compute the two-year growth rate.

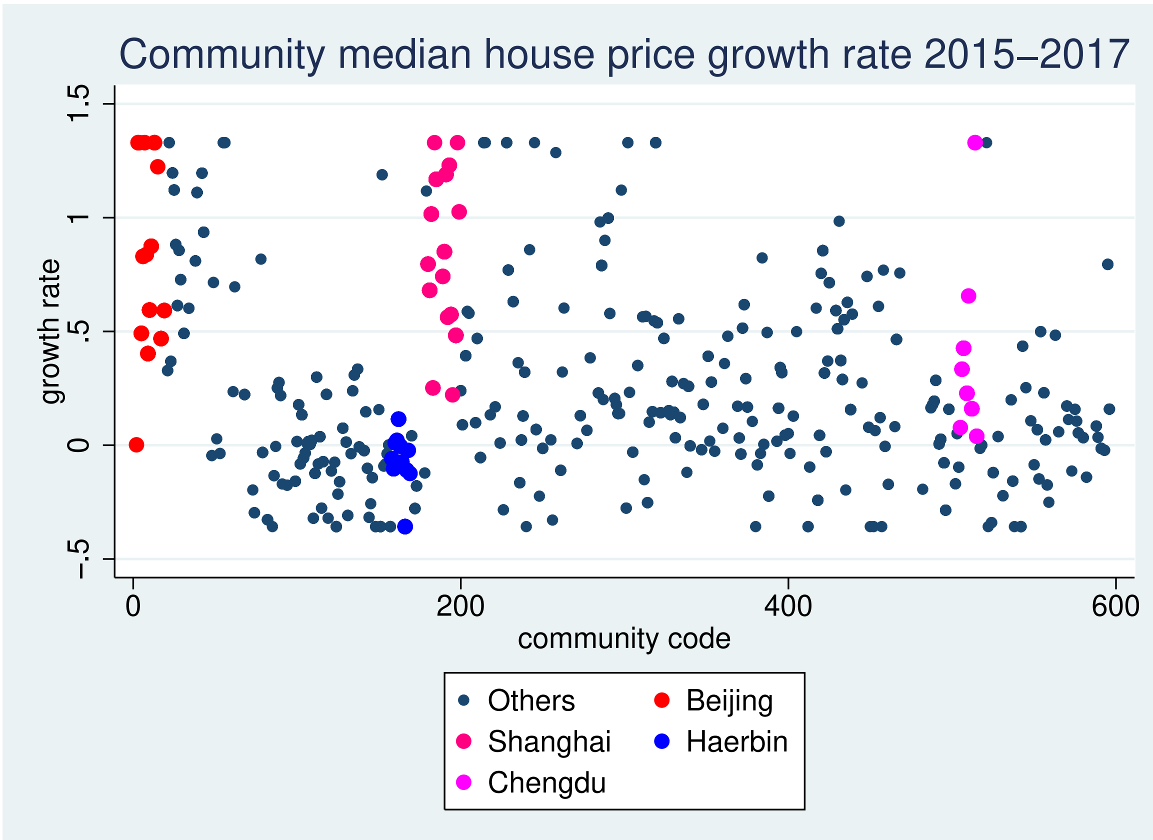

Figure 2: **Community level median house price growth rate (calculated from our data sample)**

This figure presents the two-year housing price growth rate during the period 2015-2017 across communities in our survey data sample. The y-axis represents the two-year growth rate of housing price, and the x-axis represents the community code. Each dot represents a community. We also mark the communities in four selected cities with different colors. For example, we used the red color to denote Beijing, and the blue color to denote Haerbin, a city in northeast of China. We first calculate the median housing price for each community and then compute the two-year growth rate.

C Compared to the CFPS data

Here, we compare the statistics from the two survey data CHFS and CFPS. Both samples include the rural households. They are all full sample.

Table 25: **Sorted by the growth rate of net worth (CHFS data)**

	obs	g_w	g	s	r_w	r_l	r_k
all	25280	14.52%	8.09%	29.92%	21.51%	10.63%	10.89%
q1	5067	-86.64%	-88.79%	15.90%	13.48%	6.17%	7.31%
q2	5008	-39.04%	-43.65%	27.17%	16.95%	8.06%	8.89%
q3	4807	6.20%	-0.33%	32.43%	20.13%	9.89%	10.24%
q4	5168	58.54%	50.26%	34.76%	23.82%	12.38%	11.43%
q5	5230	248.52%	233.34%	33.60%	45.20%	22.52%	22.68%

Table 26: **Sorted by the growth rate of net worth (CFPS data)**

	obs	g_w	g	s	r_w	r_l	r_k
all	9104	16.95%	11.09%	16.34%	35.86%	19.65%	16.22%
q1	1846	-81.61%	-84.10%	8.98%	27.73%	15.48%	12.24%
q2	1810	-35.34%	-39.43%	13.45%	30.37%	16.66%	13.72%
q3	1770	4.25%	-0.49%	14.44%	32.84%	18.75%	14.09%
q4	1865	56.10%	50.02%	18.55%	32.80%	18.36%	14.45%
q5	1813	248.46%	230.87%	23.40%	75.19%	38.18%	37.01%

1. CHFS data is 2015-2017, and CFPS data is 2014-2016.
2. The distributions of wealth growth g_w are quite similar in the two dataset.
3. The saving rate of CHFS is higher than that of CFPS. This is due to the under reported income level in CFPS.

D Compared to the SCF data

In 2009, the Federal Reserve Board (FRB) designed and implemented a follow-up survey of families that had participated in the then most recent wave of the Survey of Consumer Finances (SCF) in 2007. So, for the 2007-2009 survey, it is a panel, and therefore we can calculate the household-level wealth growth rate and do the same exercise as in our paper.

The growth rate of net worth in the SCF data is also quite volatile. However, it is the period of financial crisis. So, the average growth of net worth is negative. But for the top group, it is quite high: 116.8%.

Table 27: **Sorted by the growth rate of net worth (SCF 2007-2009 panel survey)**

	g_w
all	-25.64%
q1	-81.11%
q2	-48.75%
q3	-22.20%
q4	4.61%
q5	116.8%