

Housing Provident Fund and Homeownership

1. Introduction

There are three obstacles on the way to homeownership: wealth, income and credit constraints. A homebuyer needs to accumulate enough wealth either to pay the price of a house in full or the required amount of down payment for a mortgage loan (i.e., the wealth constraint). If a mortgage loan is secured against the property, the homebuyer also needs to be able to cover the monthly mortgage payment (i.e., the income constraint). Finally, credit needs to be available such that the individual is able to borrow against the property (i.e., the credit constraint). Using US data in 1989, 1995 and 1998, Barakova et al. (2003) found that in the 1990s, homeownership rate in the US was nearly halved due to these constraints. In other words, if all three constraints can be lifted, i.e., people have enough money for both the down payment and monthly housing expenses, as well as being about to secure a mortgage, homeownership could be doubled in the 1990s.

However, overcoming these obstacles, particularly the wealth constraint, is very challenging. People simply do not save enough. A report by the US Federal Reserve reveals some disturbing facts among American citizens. Only 40% of adults believes that their retirement savings is sufficient, and 25% of the interviewed individuals have no savings for retirement or pension. 40% of the adults cannot cover an unexpected expense of \$400 (US Federal Reserve, 2018). These people are basically living from paycheck to paycheck, with little saving in their bank account. How can people be so reckless when facing important decisions such as retirement and pension plans?

Behavioural economist Richard Thaler and Hersh Shefrin provide an elegant explanation to this puzzle. They describe human being as farsighted planners and myopic doers at the same time (Thaler and Shefrin, 1981). When we plan for future, we act like the owner of our live and make responsible and sensible long-term plans. However, when it comes to implementing the plans, we often cannot control our desire to chase immediate satisfaction and subsequently forgo well-intended longterm plans. This is very similar to the agency conflict between owners and managers of a business, except that we the owners are fully responsible for the loss of control of managers. We human beings are simply not good at self-control.

Thaler and Shefrin's work offers more than just some comfort to us by showing that the lack of self-control in financial planning is a rather common trait of *Homo Sapiens*. It also highlights an important aspect of decision making under risk and uncertainty – we need help to overcome this self-control problem. If left to our own device, we do not always make decisions that optimise the outcome for us and the society. Specifically, if government, firms, or even ourselves can put together some schemes that can better align our intentions and actions, we could be better prepared for our future. This is where libertarian paternalism can potentially be helpful.

Libertarian paternalism is first proposed by Thaler and Sunstein in their presentation at the 2003 American Economic Association meeting (Thaler and Sunstein, 2003), and later rephrased as *Nudge* in their popular book (Thaler and Sunstein, 2009). Policies designed under libertarian paternalism allow people to choose freely among carefully designed options with the goal of influencing the choices of the decision maker in a way that will make him/her better off. In other words, choices are carefully designed to nudge decision makers to choose the intended one, or the one that can make him/her better off. Thaler and Sunstein's Save More for

Tomorrow (SMarT hereafter) experiment in the US (Thaler and Benartzi, 2004) is a good example of libertarian paternalism.

Thaler and Sunstein designed SMarT to help employees to save more into their pension account. Employees are given the choice of joining the plan. Once joined, their contribution to their pension account will be automatically and proportionally increased when they have a pay raise. The contribution rate will increase until a pre-set maximum level is reached, and employees can opt out of the SMarT scheme at any time. SMarT is paternalistic, because it has a clear objective to encourage employees to save more into their pension plans. SMarT is also liberalistic because employees are free to join or quit. The plan makes the increase of pension contribution upon a pay raise a default option, which is automatically executed without requiring active involvement of employees. When we have a pay raise, increasing the contribution rate to our pension account is a rational move, but is unlikely to make it to our to-do-list. We know it is important, but we often procrastinate on unpleasant tasks such as cutting back our take-home pay by putting more money away in pension accounts. SMarT programme is designed to help us to overcome such loss aversion tendency.

Thaler and Sunstein experimented SMarT programme with a midsize manufacturing company in 1998 and follow the participants through four pay raises. A total of 207 employees were given the options to join the scheme, and 162 of them accepted the scheme. It is worth noting that the majority workers that they worked with lived paycheck to paycheck and can barely make ends meet. Therefore, if the scheme works for them, it can have some significant and positive impact on their retirement life. Although the sample size is small, the effect size is substantial. The average saving rates for SMarT participant increased from 3.5% to 13.6% in just 40 months. In contrast, the average contribution rate of employees who declined the SMarT plan is only 5.9%.

Moreover, only 32 employees opted out the scheme between the four pay raises. This means the majority of the participants are comfortable with the high saving rate in the scheme. From saving nothing to putting aside more than 10% of wage income into pension account, SMarT participants are nudged into a healthy financial habit. They were able to save more into their pension plan but did not do so until they joined SMarT. The scheme helped them to overcome the self-control or procrastination problem.

Saving for housing shares much in common with pension plans. Both requires the will power and commitment to save over a long period of time. Therefore, there is a considerable room for libertarian paternalism to be applied in policies promoting homeownership. In this chapter, we use the housing provident fund (HPF) scheme in China to illustrate how compulsory saving for housing can help households to achieve homeownership.

2. Housing Provident Fund in China

The housing provident fund was put into place to address two pressing issues in China. First, housing prices had been increasing rapidly since the marketisation of the residential property sector. Housing affordability became problematic in many Chinese cities. Second, although mortgage market had been growing fast, it struggled to keep up with the demand. Home mortgage balance as a percentage of GDP in China remains well below the level that is prevalent among developed countries. By enrolling employees in the HPF scheme, there will be a reliable and steady inflow of fund from both employees and employers into the housing market. This will help to close the gap between the supply and demand of housing fund.

When HPF was first introduced in Shanghai in 1991, it covered state-owned institutions and enterprises and joint venture between state-owned and private companies only. The contribution rate was modest – 5% for both employees and employers. After contributing to the scheme for a given period of time, HPF participants can use the money accumulated in their HPF account towards mortgage down payment, monthly mortgage repayment, or to cover housing related expenses such as home construction and improvement. HPF scheme also offers eligible members mortgage loans with favourable terms and interest rates. For example, the down payment can be as high as 30% in most of the commercial banks but is only 20% for HPF loans. The interest rate is typically 1.5% to 2% lower than prevalent commercial mortgage lending rate.

The scheme was gradually rolled out to the rest of the country. In 1994, the central government made HPF a national policy for all cities, and eventually included private companies and rural collective enterprises in the scheme in 1997. Today the HPF covers most of the full-time employees in China. The outstanding balance of the fund reach 1 trillion RMB (1 USD ≈ 7RMB) in 2005. It continued to grow at a double-digit speed in the last decade. As shown in Figure 4.1, the annual new contribution to the fund stood above 1 trillion RMB since 2013. The outstanding balance of the fund is approaching 6 trillion RMB in 2018.

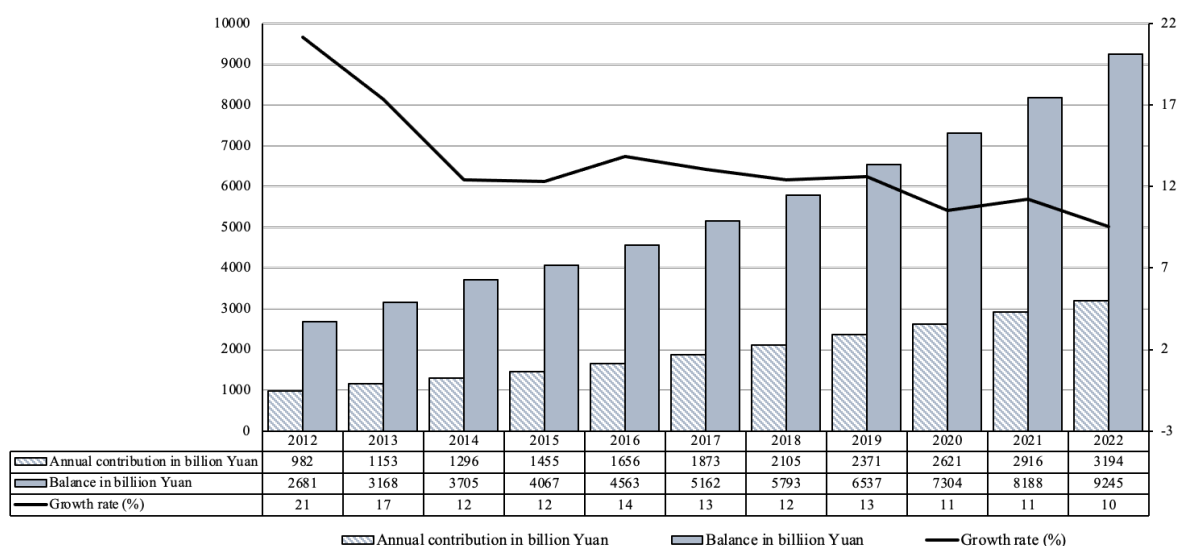


Figure 4.1: Annual and cumulative contributions to HPF (2012 – 2022)

The fund has also been well utilised. Figure 4.2 shows the annual withdraw of fund between 2012 and 2018 and the cumulative withdraw of fund since the start of the scheme. The withdraw rate, the ratio of annual withdraw over the contribution, stayed at around 70% in the last five years. The cumulative fund withdraws approach 8 trillion RMB in 2018. These statistics show that HPF participants have been actively using the fund. About one-half the withdraw is used for mortgage down payment and monthly repayment. Figure 4.3 shows that about 1 trillion worth of mortgage loan was made from HPF scheme annually since 2015. The ratio between outstanding mortgage loan to outstanding fund balance has stabilised at around 70% in the last five years.

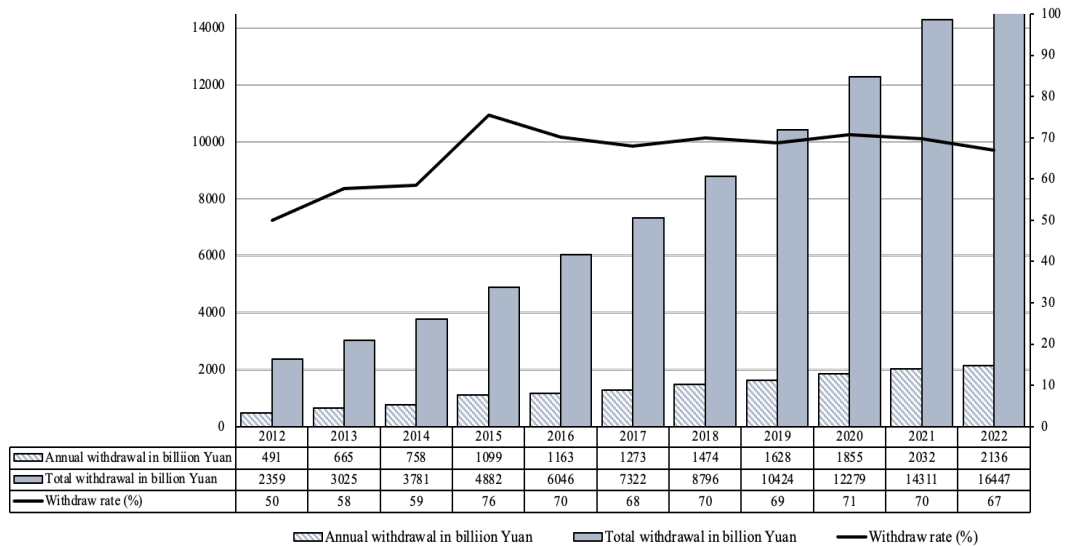


Figure 4.2: Annual and cumulative withdraw from HPF (2012 – 2022)

The sheer size of China’s HPF scheme makes it the largest social housing programme in the world (Chen and Deng, 2014). In 2018 alone, HPF scheme saved homebuyers over 20 billion RMB in mortgage loan interest payment, calculated based on the total new mortgage loan issued in that year and up to 2% interest rate gap between HPF and commercial banks. At the individual level, the benefit of the scheme is also substantial. The contribution rate varies greatly among cities, ranging anywhere between 5% and 20%. However, the prevalent contribution rate is over 10% in recent years. Because employers are required to match employee’s contribution, this means HPF participants can save as much as 40% of their salary in their HPF account. In cities with a house price to annual income ratio of 5, an HPF participant could save enough money in their HPF accounts for HPF loan down payment in five years and use the HPF monthly contribution to pay off the loan in about 20 years. Although this is the best-case scenario by assuming maximum contribution rate, non-interrupted employment and a low house to income ratio, it does show how much HPF potentially help its participant to acquire homeownership. Under the best-case scenario given above, by using HPF contribution only, an individual could get on the property ladder in 5 years, and eventually own his/her home fully in about 25 years.

The HPF scheme helps its participant to leap over all three hurdles mentioned at the beginning of this chapter. By using the cumulative contribution into HPF account as mortgage loan down payment, the wealth constraint can be lifted. HPF participants also can use money in their HPF account towards monthly mortgage repayment. This helps them to overcome the income constraint. The HPF mortgage loans, which have more favourable terms and interest rate than commercial mortgage loans, are much better options for households with credit constraints. Therefore, HPF scheme should have a positive effect on homeownership in China.

The HPF scheme is also a good example of libertarian paternalism. By making HPF contribution a default for both employers and employees, the scheme makes saving for housing easier. It deals with the procrastination issue effectively. Secondly, by putting money into a designated HPF account, participants have a mental account for housing established, and will be more likely to save more for housing on their own as well. This is the effect of mental accounting. Evidences show that money with ambiguous classification or purposes is easy to be spent. Having a designated bank account for housing helps HPF participants to create a designated housing expenses account in their mind as well. It at least increases the possibility

of saving more for housing. Finally, the monthly automatic transfer of salary into HPF account and the restrictive use of HPF fund resolve the self-control problem. HPF participant do not have the option to skip one month's saving into the HPF account, and to use the fund for non-housing purposes. It is an effective tool to align long-term goal (homeownership) and short-term actions (saving and spending).

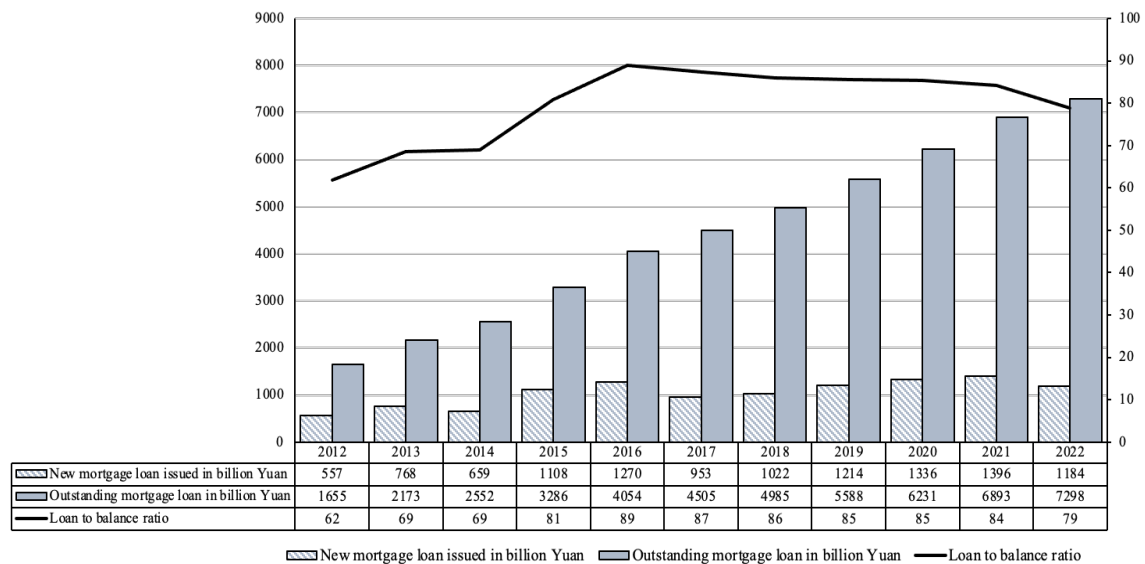


Figure 4.3: Mortgage loan landing by HPF (2012 – 2021)

3. Case Data

There are two types of data in the studies of housing provident fund in China. The first group contains aggregated data at city level, published by local statistics offices and HPF centres. For example, Deng et al. (2019) use city level aggregated data to study the performance of HPF between 2015 and 2018. The data are retrieved from the report of HPF centres in 30 Chinese cities. Although this type of data are available for free from reliable sources, it can only help us to see the ‘big picture’. Variations among individuals are averaged out. For example, Deng et al. (2019) can only find out the determinants of overall ‘HPF loan beneficiary rate’, which is defined as the ratio of HPF participants taking out a subsidized loan for home purchase in each city in a given year. It is impossible to evaluate whether the scheme help people to achieve homeownership at the individual level.

Yeung and Howes (2006) used data from Shanghai between 1990 and 2000 to analyse whether HPF benefited the low-come households in Shanghai. Given that the HPF was first piloted in Shanghai in 1991, the evidence presented in this paper is helpful. Their conclusion is that the scheme has been well received by the locals, indicated by the rapid increasing number of participants taking out home purchase loans from their HPF accounts. This indirectly benefited developers and other homeowners in the city by increasing housing production. Nevertheless, the data are quite dated, and the anecdotal findings are restricted to Shanghai only. It is difficult to separate the effect from other homeownership determining factors, such as income and household demographic characteristics.

Tang and Coulson (2017) used the 2011 Chinese Household Finance Survey data to examine the extent to which HPF encourages the acquisition of owner-occupied housing. Their

data set include more than 6,000 households across China, with comprehensive information about household and individual characteristics. This allows them to identify the relationship between HPF participation and homeownership at the individual level. Indeed, they found that participating in the HPF programme significantly increases the likelihood of being a homeowner. However, their analysis also revealed some puzzling effect of HPF. Specifically, they found that the likelihood to be a homeowner decreases as the length of participation in HPF increases. The authors' interpretation is that "the home purchase, if undertaken as a result of HPF enrollment, takes place very soon after said enrollment." However, it appears to be a result of data limitation.

Their HPF variables are constructed based on self-reported information from survey respondents. The survey was conducted in 2011, which is more than 15 years after the scheme was first implemented to state owned institutions and companies and joint-venture companies, and more than 10 years after the scheme was extended to cover employees in private sectors. However, the average years of enrolment in the HPF programme reported by the respondents is only 0.616 years. The participation rate is also small – the proportion of households participating in the HPF programme is only 17.7%. Their measurement of HPF participation seems to contain a lot of reporting errors.

Using a similar type of data source, Xu (2017) circumvented this issue by using an indirect, but more reliable, measurement of HPF participation. Xu's data are retrieved from the China Health and Nutrition Survey (CHNS) between 1989 and 2009. Unlike the China Household Finance Survey, Xu's database does not have direct information on HPF. Respondents of CHNS were not asked about their participation in HPF. Because the implementation of HPF was ordered by the state and reinforced by state regulations, the enrolment to HPF is automatic as long as an individual is working in an eligible company. The CHNS has eight waves of surveys in between 1989 and 2009. Xu uses samples before the implementation of HPF (i.e., year 1989, 1991, and 1993) as the control group, and samples after the implementation (i.e., year 1997, 2000, 2004, 2006 and 2009) as the treatment group. She then used the employment sector of the household head and the spouse as the proxy of the HPF benefit received by the household. This is a much more reliable measurement of HPF participation, because the employment sector is a piece of explicit and objective information. It is not subject to significant reporting errors.

With this clever design, Xu (2017) found that the length of enrolment in the HPF scheme has significant and positive impact on homeownership. The effect is robust after controlling for demographic and socio-economic factors such as household size, age, education, income, and the sex of the first child. The conclusion is that HPF is an effective nudge to help Chinese citizens to achieve homeownership.

In this case study, we use the same data source and methods in Xu (2017), but extend her study to the three most recent waves of CHNS in 2009, 2011, and 2015. In Table 4.1 the variable definitions and descriptive statistics are given. We also include the name of the CHNS data sets and the original variable names in these datasets to facilitate the replication and/or extension of the results in this chapter.

The dependent variables in this case study is *owner*, a dummy variable equals one for household with full ownership of their home. The proportion of homeowner has been increasing steadily over the years, according to our sample. Figure 4.4 shows that homeownership rate rise from 79% in 1989 to 91% in 2015. The average HPF participation

length shows general increasing trend for both individuals (i.e., household heads) and household (i.e., all household members' HPF participation years combined). Note that the variation in individual HPF participation length is subjected to changes of household head too. For example, addition of new households with younger household head will reduce the average of the HPF statistics, which is what happened in year 2015.

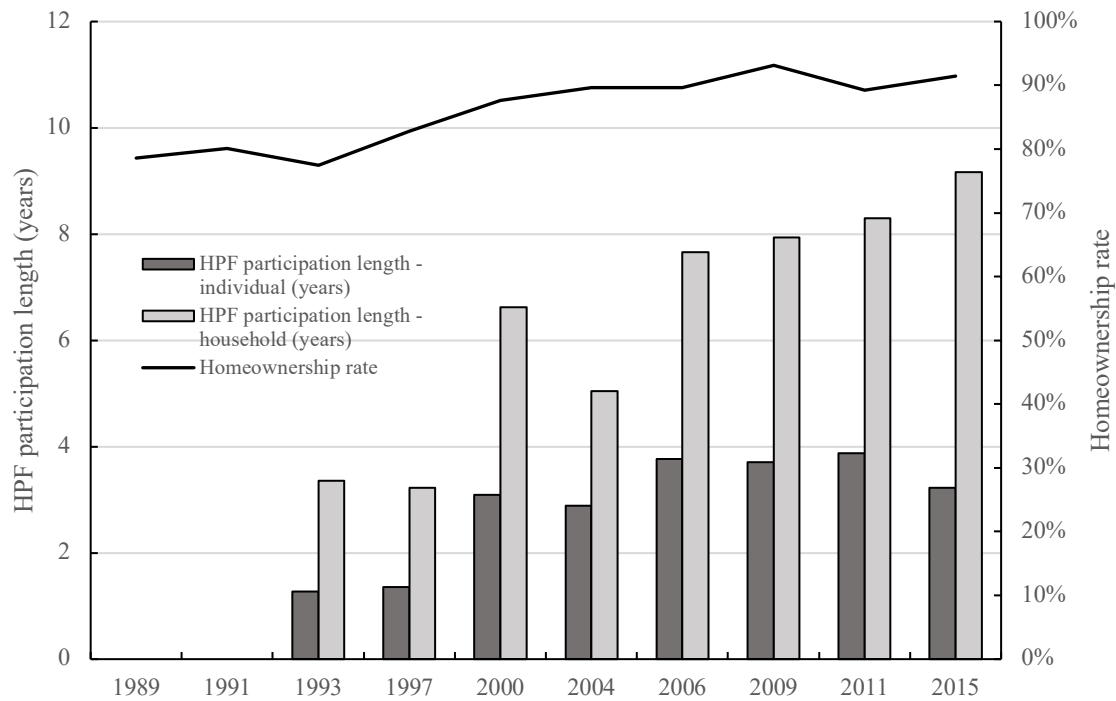


Figure 4.4: Homeownership rate and HPF participation (years)

The key variables in this case study are *hpflength*, the length of enrolment in HPF in years, and *hh_hpf*, the total length of enrolment in HPF of all household members. The first variable is calculated by using household head's record, and the second variable is created by using information from all members from the same household who are working full-time. The two variables are created based on respondent's employment sectors. State-owned companies are required to enrol their employees to HPF in 1994¹. Therefore, all employees working in the state-owned sector are automatically included in the HPF scheme. Collective and private companies are required to participate in HPF in 1999. We assume that employment status did not change significant between survey waves. For example, if a respondent reported to be employed full-time in a state-owned company in the 2011 wave, we will count her HPF participation year to be three for the 2011 wave. In other words, we assume that she did not change job between the last wave in 2009 and the current wave in 2011. By adding up HPF participation years in each wave we obtain *hpflength*. By adding up *hpflength* for all members in the same household we obtain *hh_hpf*.

¹ The notable drop of the 'Total as % of all respondent' in year 2004 is a combined result of the downsizing of state-owned sector in 1990s and the changes in survey methods. This is also another reason for us to avoid using data around that period of time.

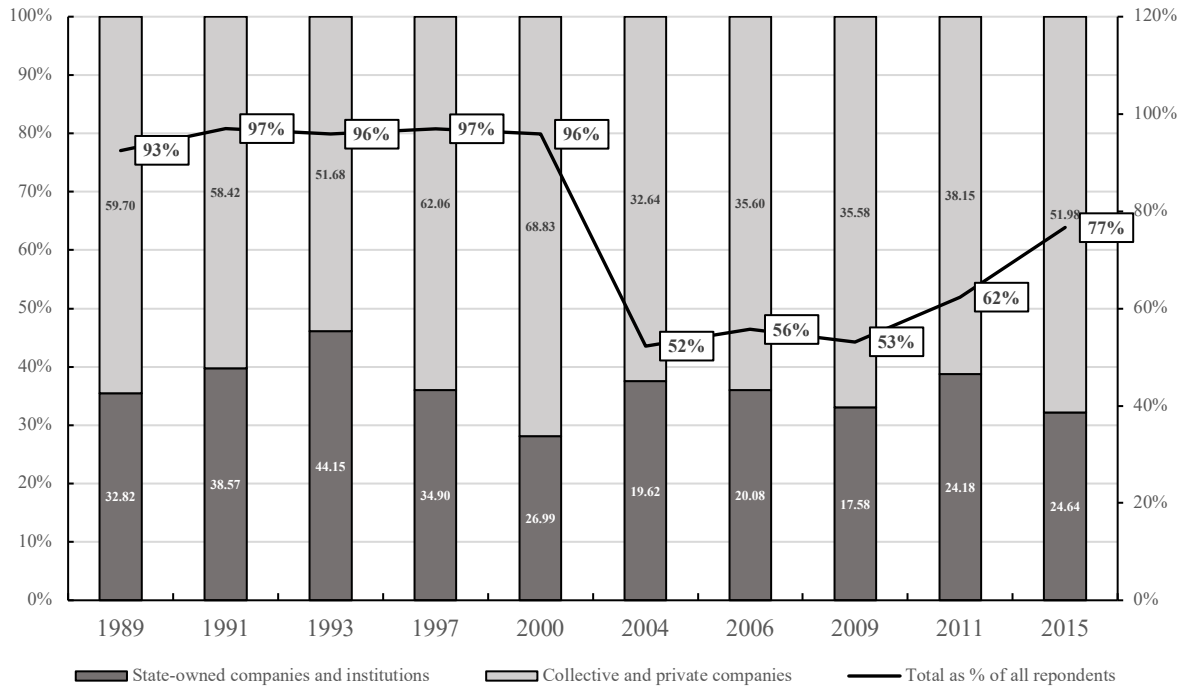


Figure 4.5: Distribution of employment sectors

We also have demographic and socio-economic indicators included in the data set, as shown in Table 4.1. We use *sex* and *mson*, a dummy variable that equals one when the household head is married and has a son, to capture some characteristics that are unique to Chinese society. China implemented a one-child family plan policy in the 1980s. Although the policy has not been strictly enforced in rural areas, most of the urban families have one child only now. Historically, Chinese families prefer male offspring, because they are the ones who are going to carry the family last names and continue the ‘blood line’. Economically, sons are also the informal pension plans and insurance policies for parents, because there has not been a reliable pension or retirement scheme throughout most of the China’s history. Because the tradition is to live with a son instead of a daughter when one is old, having a male descendent is more than just a social norm priority, but also a very important economic decision. Due to selective abortion and misreporting (i.e., families with female new-borns simply do not register their daughter so that they could have a son later), the sex ratio at birth in China has become the most skewed in the world. In the 2018 Gender Gap Report by the World Economic Forum, China is ranked as the worst of the 149 countries covered in their Global Gender Gap Index system in terms of sex ratio at birth and female healthy life expectancy over male ratio (World Economic Forum, 2018). The sex ratio (male over female) at birth remains at around 1.15 in the last decade, according to the World Bank².

Housing market is heavily influenced by demographics. This policy induced gender imbalance led to some intriguing changes in China’s housing market in the last few decades. Specifically, when there are fewer females available in the marriage ‘market’, males need good signals to increase their marriageability. Evidences show that Chinese men have been increasingly using houses as such a signal. A team of Chinese and American researchers analysed over 1,000 rural households in China in 2011. Their results suggest that owning a

² <http://api.worldbank.org/v2/en/indicator/SP.POP.BRTH.MF?downloadformat=excel>. Accessed on 6 September 2019.

larger house not only increase a male's chance to end singlehood by the age of 30, but also helps him to find a taller wife (Fang and Tian, 2018).

Unfortunately, this created a vicious cycle in the intersection of the housing and marriage market. The high male-to-female ratio prompted families with sons to save more for buying 'marriage houses' in an effort to increase their sons' competitiveness in the marriage market (Du and Wei, 2013; Wei and Zhang, 2011; Wei et al., 2017). This will push the house prices up, making marriage even more costly and difficult, and ultimately reduce the rate of initial marriage (Wrenn et al., 2019). Given this important role of gender plays in housing market, we include *mson* in our model. In Xu (2017), a similar approach is adopted by including a dummy variable that equals one if the first child of a household is male. Note that both approaches assume that there are families with more than one child. Statistics show that the one-child policy has not been enforced strictly in many parts of the country, and in rural China in particular. Also, ethnic minorities are allowed to have the second child. Therefore, families with more than one child are not common, and also not rare either in some parts of China.

Given the importance of homeownership for males in China, we expect that male respondents will be more motivated to save more for housing, both for themselves and for their sons. As the gender of respondent significantly influences saving behaviours of Chinese residents, we include both the household head's sex (*sex*) and *mson* in our analysis to control for this factor. It is worth noting that *sex* was not included in Xu (2017). Therefore, it will be interesting to find out whether their conclusion still holds after this important control variable is added to the model.

Table 4.1: Variable definition and descriptive statistics

Variable name	Definition	CHNS datafile name	CHNS variable name	N	Mean	Standard Deviation
<i>owner</i>	=1 if the household head owns the property	Asset_12	L9	5101	0.92	0.27
<i>secondhome</i>	=1 if the household head owns a second home	Asset_12	L18A	5081	0.10	0.29
<i>hpflength</i>	Length of enrolment in HPF in years	jobs_12	B6	5101	4.24	4.77
<i>hh_hpf</i>	Total length of enrolment in HPF of all household members	jobs_12	B6	5101	8.14	8.92
<i>sex</i>	=1 if male	relationMast_pub_00	sex_1	3504	0.80	0.40
<i>mson</i>	=1 if the household head is married and has a son	relationMast_pub_00	rel_1, rel_2, and sex_2	5101	0.46	0.50
<i>age</i>	Age in years	surveys_pub_12	age	5101	55.09	10.69
<i>hhincome</i>	Household income in 1000 RMB	oinc_12	b2e	2008	42.86	67.50
<i>city</i>	=1 if live in city	surveys_pub_12	stratum	5101	2.16	1.05
<i>sub</i>	=1 if live in suburban area	surveys_pub_13	stratum	5101	0.16	0.36
<i>local</i>	=1 if live in town or county capital city	surveys_pub_12	stratum	5101	0.17	0.37
<i>highschool</i>	= 1 if high school diploma	educ_12	a12	5101	0.13	0.33
<i>college</i>	=1 if college degree	educ_12	a12	5101	0.24	0.43
<i>scollege</i>	=1 if spouse has college degree	educ_12	a12	4186	0.11	0.32
<i>shighschool</i>	=1 if spouse has high school diploma	educ_12	a12	4186	0.21	0.41
<i>sindincome</i>	=spouse's annaul wage income in 1,000 RMB	oinc_12	b2e	1011	39.92	59.62
<i>sage</i>	Spouse's age	surveys_pub_12	age	4202	53.17	10.75

4. Case questions and discussions

We estimated a total of six fixed effect panel data models as given in Table 4.2. The first two models have the key HPF variables as the independent variable only, besides the wave and province fixed effect. Model (3) and Model (4) include all independent variables given in Table 4.2. The squared term of age is also added to capture any nonlinear relationship between age and homeownership. The last two models include variables with significant coefficient estimate only. Note that some of the variables included in Models (3) and (4) are highly correlated, such as *age* and *sage*. Therefore, the coefficient estimates suffer from multicollinearity. The variables in Model (5) and (6) are chosen by using the stepwise selection algorithm.

We also run a model with *secondhome* as the independent variable. *secondhome* equals one if the household head owns more than one property. This analysis will help us to understand whether HPF helps households to accumulate wealth in the housing sector by purchasing a second home. Given that the pension and life insurance markets have not been well developed and functioning in China, investing in the housing market is an important and viable investment option. Since the implementation of HPF in 1994, many participants have accumulated enough wealth either in their HPF account or by saving more elsewhere due to reduced housing cost through the use of their HPF savings. This may help them to add a second home to their portfolio. This analysis will reveal whether HPF plays a role in the use of residential property as investment good as well. A total of six models are estimated using the same strategy as in Table 4.2, and the results are presented in Table 4.3.

secondhome is based on a question that is available in Wave 2015 only. Therefore, we restricted our analysis of second home ownership to survey data in 2015 only. This give us a total of 1,424 households with complete information for all variables that we used in this case study. We use linear probability models to obtain coefficient estimates. Using the last two models in each table, we can answer the following case questions.

4.1 Did HPF help Chinese households to achieve homeownership?

The first two models in Table 4.2 allows us to examine the impact of HPF participation on homeownership preliminarily. The coefficient estimates of *hpflength* and *hh_hpf* are both significant and positive. This indicates that both the household head's own contribution and the combined contribution to HPF by all household members improved the family's chance to own their home. The effect size of *hh_hpf* (combined HPF participation length among all household members) is smaller than that of *hpflength* (HPF participation length of household head only). Therefore, household head's participation in HPF is more important than that of other members in the same household to increase the probability of homeownership acquisition. This is because the effect of *hh_hpf* is the average of the effect from household head (i.e., *hpflength*) and that of other members in the same household. On average, one more year of participation in HPF by the household head will increase the chance of becoming a homeowner by 0.24%; while one more year of participation in HPF by all members in the same household combined will increase the probability of being a homeowner by 0.15%.

We improve Models (1) and (2) by including other control variables. The models with all available control variables do not offer much helpful information. As pointed out above, the 'full picture' is quite murky due to the high correlation among variables. This is inevitable when one is using a large number of demographic and socio-economic factors. For example, holding other variables constant, individuals with higher education qualifications tend to have

higher income; married couples are more likely to higher household income. The statistics term for overlapping information amount independent variables is multicollinearity. The regression technique we employed is not designed to handle such a situation, because it assumes that all independent variables are independent from each other (i.e., not highly correlated with each other). The solution to multicollinear is to remove variables that are highly correlated with other variables in the model. This leads us to Models (5) and (6) in Table 4.2, where only statistically significant variables are left.

The coefficient estimates of *hpflength* and *hh_hpf* remain significant after other important homeownership determinants are added to the models. The size of the effect increases slightly, from 0.24% to 0.2% for *hpflength* and from 0.15% to 0.21% for *hh_hpf*. Overall the results are insensitive to the addition of other variables, which is a good sign of the robustness of our findings.

The coefficient estimates of control variables are also consistent with existing findings in the literature. First, both variables controlling for the sex ratio effect (*sex* and *mson*) are significant with a positive sign. Males are about 3% more likely to be homeowners. If a household head has a son, the chance of the household head being a homeowner rises by over 2%. We also further interrogate this finding by including indicators of single-mother, single-father, individuals who are never married, total number of children in a household, total number of sons in a household. These variables turned out to be unimportant in determine homeownership. For brevity the results of these analysis are not presented in this chapter, but available upon request.

The effect of age on homeownership is nonlinear. It first increases steadily as age goes up, but eventually tappers off. This makes sense because people usually own their home during mid-age, when they are financially established and when the need for homeownership is the strongest. We did not include respondents who are 75 years or older because their housing needs are complicated by retirement plans and inter-generational transfer of wealth. We also transformed *age* into age groups (e.g., young, middle aged, and old subgroups) and run the model with these alternative definitions of age. The conclusion remains the same.

Last, the coefficient estimate of household income (*hhincome*) is significant and positive. In general, households that have been contributing to their HPF accounts have higher household income, because they have been working fulltime. Therefore, household income is correlated with HPF. This complicate our analysis because, on the one hand, excluding *hhincome* from the model will potentially overestimate the effect of HPF participation, and on the other hand, including both variables in the model has potential multicollinearity issues. Fortunately, the correlation between the two variables is not high enough to cause problems. Specifically, the effect of HPF participation remains largely the same after *hhincome* is added in Models (5) and (6). After controlling for income effect, the positive relationship between HPF participation and homeownership remains.

In conclusion, our findings suggest that the participation in HPF scheme significantly increase household head's chance to become a homeowner. The longer that the household head and other members of his/her family contribute to their HPF accounts, the more likely the household head owns his/her home.

4.2 Did HPF help Chinese households to purchase a second home?

We now turn to Table 4.3 to answer the second case question. The dependent variable in these models is *secondhome*, which equals one when the household heads owns a second home. The determinants of second home ownership are largely the same as those for *owner*: HPF participation, sex, age, and household income. However, the nature of the relationship changes for some variables.

First, HPF participation significantly increases the chance of a household head to own a second property. One more year of HPF participation by the household head increases the second-home ownership probability by 0.35%. The effect size is very similar for *hh_hpf*, which means that to buy a second house, the contributions from other members in the household are equally important as the household head's own effort. This is different from the findings in the last section, which primarily concerns the acquisition of first-home ownership (only 10% of the households in our sample own a second home). Also, the effect size of HPF participation by household head is about 20% stronger for second-home ownership than that for first-home ownership (i.e., 35% vs. 29%); and the effect size of HPF participation by all household members is more than 79% stronger for second-home ownership than that for first-home ownership (i.e., 37% vs. 21%). HPF participation plays a bigger role in the acquisition of second-home ownership.

Second, the effect of sex ratio is completely different. Whether the family has a boy does not affect the outcome of *secondhome*, while families with female household heads are more likely to own a second home. We cannot jump to the conclusion that female household heads manage their finances better so that they stand a better chance of owning a second home. Given the small sample size and the short history of China's residential property market, our data is far from ideal to reveal the complex structure that underlies the decision of purchasing a second home. This finding should be further validated with more data available in future survey waves.

Finally, the effect of age is simpler. The relationship is linear. On average, older household heads are less likely to own a second home. Once again, this conclusion needs to be checked with more data because our sample contains survey data from 2015 only (i.e., second-home ownership information is available from wave 2015 only).

In summary, HPF participation is helpful for Chinese households to purchase a second home as well. The effect of HPF participation is stronger for second-home ownership acquisition.

Table 4.2: Regression model output (dependent variable: *owner*)

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
<i>hpflength</i>	0.0024*** (0.0009)		0.0019 (0.0039)		0.0029* (0.0015)	
<i>hh_hpf</i>		0.0015*** (0.0005)		0.0028 (0.0021)		0.0021*** (0.0008)
<i>sex</i>			0.1014* (0.0520)	0.1016** (0.0514)	0.0336* (0.0176)	0.0354** (0.0174)
<i>mson</i>			0.0719* (0.0396)	0.0723* (0.0395)	0.0255* (0.0149)	0.0216* (0.0149)
<i>age</i>			0.0042 (0.0222)	0.0027 (0.0220)	0.0131* (0.0074)	0.0128* (0.0073)
<i>age2</i>			(0.0001) (0.0002)	(0.0001) (0.0002)	-0.0001* (0.0001)	-0.0001* (0.0001)
<i>hhincome</i>			0.0002 (0.0003)	0.0003 (0.0003)	0.0002* (0.0001)	0.0002* (0.0001)
<i>City</i>			(0.0023) (0.0201)	(0.0022) (0.0200)		
<i>sub</i>			0.0478 (0.0518)	0.0476 (0.0515)		
<i>local</i>			0.0722* (0.0495)	0.0715* (0.0493)		
<i>college</i>			0.1135* (0.0707)	0.1136* (0.0703)		
<i>highschool</i>			0.0865* -0.0484	0.0853* -0.0482		
<i>scollege</i>			-0.0802 -0.0672	-0.0883 -0.0673		
<i>shighschool</i>			-0.0299 -0.0513	-0.0312 -0.0512		
<i>sindincome</i>			0.0001 -0.0003	0.0001 -0.0003		
<i>sage</i>			0.0132** -0.0056	0.0126** -0.0056		
Constant	0.8473*** (0.0130)	0.8459*** (0.0131)	0.3184 (0.5466)	0.3679 (0.5422)	0.5577*** (0.2019)	0.5653*** (0.2011)
R Square	0.0239	0.0244	0.1616	0.1677	0.0465	0.0486
Adjusted R Square	0.0216	0.0221	0.0602	0.0670	0.0350	0.0372
F	10.3409	10.5696	1.5941	1.6661	4.0671	4.2595
p-value	0.0000	0.0000	0.0393	0.0269	0.0000	0.0000

* p<0.15, ** p<0.05, *** p<0.01

Table 4.3: Regression model output (dependent variable: *secondhome*)

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
<i>hpflength</i>	0.0023** (0.0009)		(0.0007) (0.0060)		0.0035* (0.0020)	
<i>hh_hpf</i>		0.0024*** (0.0005)		0.0038 (0.0032)		0.0037*** (0.0011)
<i>sex</i>			0.0199 (0.0814)	0.0137 (0.0804)	-0.0449* (0.0231)	-0.0476** (0.0228)
<i>mson</i>			0.0045 (0.0612)	0.0031 (0.0609)		
<i>age</i>			0.0267 (0.0340)	0.0211 (0.0336)	-0.0033*** (0.0010)	-0.0034*** (0.0010)
<i>age2</i>			(0.0004) (0.0003)	(0.0003) (0.0003)		
<i>hhincome</i>			0.0009** (0.0004)	0.0010** (0.0004)	0.0009*** (0.0001)	0.0008*** (0.0001)
<i>City</i>			(0.0433) (0.0312)	(0.0444) (0.0311)		
<i>sub</i>			0.2347*** (0.0801)	0.2314*** (0.0797)		
<i>local</i>			0.0279 (0.0766)	0.0276 (0.0764)		
<i>college</i>			0.0873 (0.1102)	0.0822 (0.1094)		
<i>highschool</i>			0.0614 -0.0744	0.0583 -0.0741		
<i>scollege</i>			0.0414 -0.106	0.0255 -0.1062		
<i>shighschool</i>			0.0063 -0.079	0.0055 -0.0788		
<i>sindincome</i>			-0.0001 -0.0004	-0.0001 -0.0004		
<i>sage</i>			0.0160* -0.0085	0.0152* -0.0085		
Constant	0.0661*** (0.0140)	0.0609*** (0.0141)	-0.8439 (0.8380)	-0.6932 (0.8314)	0.3951*** (0.0755)	0.3887*** (0.0750)
R Square	0.0177	0.0208	0.1974	0.2027	0.0664	0.0718
Adjusted R Square	0.0154	0.0185	0.0985	0.1044	0.0565	0.0619
F	7.5840	8.9434	1.9958	2.0631	6.6785	7.2643
p-value	0.0000	0.0000	0.0042	0.0028	0.0000	0.0000

* p<0.15, ** p<0.05, *** p<0.01

5. Summary

In this chapter, we use the HPF in China as a case study to demonstrate how compulsory saving schemes helps people to achieve homeownership. The behavioural element of the case study is self-control, or the lack of self-control for the implementation of well-intended long-term plans, such as saving for home purchase or pension. By making the participation in the HPF scheme the default option, HPF participants are nudged to save for their future housing needs. This will increase their chance to leap over the wealth and income hurdle on their road to homeownership. Meanwhile, the creation of the HPF account also help participant to set up a mental account for home purchase. This mental accounting effect could encourage HPF participant to save for housing need beyond their HPF account as well. The overall effect is higher homeownership rate among HPF participants.

Our case data support such a hypothesis. Using employment sector as a proxy of HPF participation length, we find that the longer a respondent has contributed in HPF, the higher the chance of the respondent being a homeowner. HPF participation length has an even stronger positive effect on the probability of owning a second home. Given the scale of the HPF scheme and the important role of property in the social and economic lives in China, the impact of HPF scheme is profound.

The case study is also a good example of the challenge facing studies of large-scale behavioural intervention programmes. The effect of mental accounting and nudge (e.g., default option) is usually not directly observable or measurable. Self-reported data are not always reliable, and often unavailable. In this case study, we had to use employment sector as the proxy of HPF participation level, which is far from ideal. Moreover, large-scale behavioural interventions show effect, if any, over a long period of time. There could be many other factors in action besides the behavioural intervention during this period of time. Separating the net effect of behavioural interventions, therefore, is a challenging undertaking. Although we tried to include as many explanatory variables in our models as possible, the R square of all models does not exceed 10%. This indicates that some important homeownership determinants are omitted in our models. If any of these missing variables is highly correlated with the two HPF participation variables in our models, the estimated effect of HPF participation on homeownership could be biased. Unfortunately, we don't have the information to assess whether such a bias exists. The results in this case study should be interpreted with this caveat in mind.

6. References

- 1) Barakova, I., Bostic, R.W., Calem, P.S., Wachter, S.M., 2003. Does credit quality matter for homeownership? *Journal of Housing Economics* 12, 318-336.
- 2) Chen, J., Deng, L., 2014. Financing Affordable Housing Through Compulsory Saving: The Two-Decade Experience of Housing Provident Fund in China. *Housing Studies* 29, 937-958.
- 3) Deng, L., Yan, X., Chen, J., 2019. Housing affordability, subsidized lending and cross-city variation in the performance of China's housing provident fund program. *Housing Studies*.
- 4) Du, Q., Wei, S.-J., 2013. A theory of the competitive saving motive. *Journal of International Economics* 91, 275-289.
- 5) Fang, L., Tian, C.H., 2018. Housing and marital matching: A signaling perspective. *China Economic Review* 47, 27-46.
- 6) Tang, M., Coulson, N.E., 2017. The impact of China's housing provident fund on homeownership, housing consumption and housing investment. *Regional Science and Urban Economics* 63, 25-37.
- 7) Thaler, R.H., Benartzi, S., 2004. Save More Tomorrow (TM): Using behavioral economics to increase employee saving. *Journal of Political Economy* 112, S164-S187.
- 8) Thaler, R.H., Shefrin, H.M., 1981. An Economic Theory of Self-Control. *Journal of Political Economy* 89, 392-406.
- 9) Thaler, R.H., Sunstein, C.R., 2003. Libertarian paternalism. *American Economic Review* 93, 175-179.
- 10) Thaler, R.H., Sunstein, C.R., 2009. *Nudge : improving decisions about health, wealth and happiness*. Penguin, London.
- 11) US Federal Reserve, 2018. Report on the Economic Well-Being of U.S. Households in 2017, Washington DC.
- 12) Wei, S.J., Zhang, X.B., 2011. The Competitive Saving Motive: Evidence from Rising Sex Ratios and Savings Rates in China. *Journal of Political Economy* 119, 511-564.
- 13) Wei, S.J., Zhang, X.B., Liu, Y., 2017. Home ownership as status competition: Some theory and evidence. *Journal of Development Economics* 127, 169-186.
- 14) World Economic Forum, 2018. *The Global Gender Gap Report 2018*, Switzerland.
- 15) Wrenn, D.H., Yi, J.J., Zhang, B., 2019. House prices and marriage entry in China. *Regional Science and Urban Economics* 74, 118-130.
- 16) Xu, Y.L., 2017. Mandatory savings, credit access and home ownership: The case of the housing provident fund. *Urban Studies* 54, 3446-3463.
- 17) Yeung, S.C.W., Howes, R., 2006. The role of the housing provident fund in financing affordable housing development in China. *Habitat International* 30, 343-356.