Housing and portfolio choice: Evidence from urban China

Sanbai Sun [a], Chunhua Wang [b,*], Yan Zhang [c], Ding Li [d], Chu Wei [a,*]

[a] *School of Applied Economics, Renmin University of China, No. 59 Zhongguancun Street, Beijing 100872, China*
[b] *Antai College of Economics and Management, Shanghai Jiao Tong University, 1954 Huashan Road, Shanghai 200030, China*
[c] *Survey and Research Center for China Household Finance, Southwestern University of Finance and Economics, Chengdu 6111130, China*
[d] *School of Public Administration, Southwestern University of Finance and Economics, Chengdu 611130, China*

ARTICLE INFO

ABSTRACT

Standard theory predicts that homeownership has both substitution and diversification effects on a household's investments in risky financial assets. Findings from previous empirical studies are inconclusive regarding the net effect. Using data from three surveys in urban China, this study investigates whether homeownership crowds out investments in risky financial assets. The study finds that owing a home decreases a household's probability of participating in the financial market and reduces its total amount of risky financial assets and the share in total household wealth. The crowd-out effect of homeownership on household risky financial asset investment is heterogeneous. Different from existing studies, the mechanism of the crowd-out effect is liquidity constraints rather than mortgage commitment risk, and households with multiple houses also show diversified asset allocation characteristics in China.

1. Introduction

Housing wealth is an important component of a household's wealth. It has varying effects across countries on human behavior and wealth distribution across individuals and households. For instance, the effect of homeownership on risky financial assets in China is different from that in America. In urban China, owning a home is one of the most important goals of ordinary families, and the rate of homeownership was approximately 85 % in urban China in 2012. Similarly, there is a strong preference for homeownership in the U.S. (Aratani, 2005; Tracy & Schneider, 2001) and it also remains an important goal for most Americans. The rate was approximately 65 % in the United States in 2013 (Everhardt, 2014) much lower than that in China, although the U. S. has much higher income, which increased the rate of homeownership (Lin et al., 2021). The participation rate of households in the financial market is also quite different between the two countries. In the U.S., the share of risky assets increased from 65 % in 1992 to 80 % in 2007. Approximately 50 % of U.S. households participated in the stocks and/ or stock mutual funds market in 2001 (Yao & Zhang, 2005). In contrast, the financial market participation rate was 11.5 % for Chinese households in 2012 (although 11 years later). Chinese counterparts have a lower risky financial asset holding ratio and financial market participation rate but a higher homeownership rate than those of American households.

Although the housing market between China and the U.S. is not comparable, it still raises a question: does the high rate of homeownership crowd out risky financial investments in China? The answer is inconclusive. As China has a special housing and risky financial assets market, the relationship between homeownership and risky financial investment in China may be different from other countries. First, there are some intrinsic characteristic causes for the high rate of homeownership in China. Although China reformed its housing market and abolished the welfare-oriented housing distribution system in 1998, the welfare-oriented housing distribution system allowed most urban households who worked in public sectors obtain homeownership from their organizations before 1998. Therefore, majority of the older urban native residents own their houses. Meanwhile, housing may be a form of welfare rather than financial good in the urban market, and house owners and renters have different rights in public service (for example, school opportunities) in China. Young parents must purchase a house near the school to gain the right to enroll their children, thereby increasing the rate of homeownership in urban areas.

Second, the financial market in China has not matured. China's growing stock market includes individual investors who make up most

---

of the trading volume and tends to fluctuate often. The short-term risk in the Chinese financial market differs significantly from that in a mature market. Since the reform of the welfare-oriented housing distribution system, the housing sector has grown significantly, while the financial market has developed rapidly in recent years. Third, the Chinese government institutes many regulatory measures in the real estate and risky financial markets. The government hopes the stock market could play an important role in direct financing for businesses to lower their financial cost. Nevertheless, the housing sector is regarded as an engine for economic growth. Given the rapid rise in housing prices in the past two decades, the real estate market is highly regulated in big cities, for example, housing purchase and land supply restriction. Specifically, homeownership is hardly substituted by financial investment in China. However, it is not clear whether homeownership crowds out risky financial assets in China.

The relationship between homeownership and financial assets holding has implications for understanding the markets and long-term economic development in China. Regarding the effect of housing on the risky financial assets market in China, previous studies use homeownership as a control variable but do not address endogeneity concerns. The present study aims to understand the effect of homeownership on risky financial assets holding. We construct individual- and household-level data from three recent surveys in China for empirical analyses. The instrument variables (IV) regressions show that homeownership decreases a household's (and an individual's) probability of participating in risky financial assets market significantly and reduces the household's total amount and the ratio of risky financial assets.

The present paper makes three contributions to the related literature. First, we focus on the effect of homeownership on an individual's and household's participation in the risky financial assets market in China. The econometric investigation addresses endogeneity in the data by using IVs. Second, we use different definitions of homeownership, three datasets, and various model specifications to examine the effect. The empirical results support the claim that homeownership crowds out households' risky financial asset holdings in urban China. Third, we analysis the mechanisms of the crowd-out effect of homeownership on risky financial asset in China, and found they are different from previous studies.

The remainder of the paper is organized as follows. Section 2 provides a brief review of related literature. In Section 3, we describe the data and the empirical strategy. Section 4 presents the main empirical results of different data. Finally, Section 5 concludes.

2. Literature review

There are many related studies on the relationship between homeownership and risky financial asset market participation; however, the findings are inconclusive. In a review, Chetty and Szeidl (2010) find that many theoretical discussions predict that homeownership reduces the households' demand for risky assets because it puts the households at higher risk (Brueckner, 1997; Chetty & Szeidl, 2007; Flavin & Yamashita, 2002; Grossman & Laroque, 1990). However, previous empirical studies find no systematic relationship between homeownership and portfolio choice, especially for the risky financial assets holding (Cocco, 2005; Fratantoni, 1998).

It is widely agreed that homeownership represents individuals' consumption decisions and investment decisions (Waggle & Johnson, 2009). It has two effects on the decision on risky financial market participation; one is the "substitution effect." In owning a house, the equity proportion of the net worth of households was reduced (e.g., bonds and stocks), indicating a substitution effect of homeownership for risky stocks (Yao & Zhang, 2005). The negative relation could also result from a reduced willingness to take on stock market risk when leveraged real estate represents a significant background risk (Curcuru et al., 2010). Simultaneously, some households invest in housing through

mortgages from the banks, exposing them to "mortgage commitment risk," and thus holding more conservative financial portfolios (Chetty & Szeidl, 2010; Fratantoni, 1998). Therefore, homeownership results to a financial burden (Zheng et al., 2020). Using data from the Netherlands, Dröes and Hassink (2013) conclude that owning a house may add more price risk than hedging. As a family's total wealth is limited, they will keep fewer liquid assets to pay the mortgage.

The second effect of homeownership is the "diversification effect". Home equity is the most important component of wealth for most homeowners. Houseowners' wealth accumulates more quickly over time (Di et al., 2007). They also save more and are financially wealthier than tenants (Lersch & Dewilde, 2018; Paz-Pardo, 2021). A housing transition from renting to owning creates approximately $1300 in measured benefits in the U.S. (Coulson & Li, 2013). Homeowners get more benefits from owning a house, increasing the holding of their risky financial assets to diversify their portfolios. Moreover, the low correlation of housing returns with the stock market suggests it has diversification advantages that could encourage greater stockholding (Curcuru et al., 2010). Empirical studies find that households with a higher home-to-net worth ratio allocate more assets to stock (Waggle & Johnson, 2009).

Previous studies test the effects of homeownership on household's participation in the risky financial assets market. They find that homeownership and home equity are significant in portfolio choice (Chetty & Szeidl, 2010; Cocco, 2005; Henderson & Ioannides, 1983). Empirical studies provide evidence for both effects by using survey data from various countries (e.g., Chetty & Szeidl, 2010; Cho, 2014; Fratantoni, 1998; Waggle & Johnson, 2009; Yao & Zhang, 2005).

The present study is mainly related to two lines of the empirical literature. The first is related to factors that determine a household's decision to purchase risky financial assets. Previous studies focus on factors such as income, age, gender, educational attainment, marital status, and wealth of individuals or households. Researchers find that stock holdings are related to age and education (Campbell, 2006; Guiso et al., 2000). Halko et al. (2012) find that the effect of gender on the conditional equity share is significant in Finland.

Other variables are also considered in the extant analysis. Fratantoni (1998) shows that the homeowner's mortgage payment or income ratio decreases the risk assets share. Vissing-Jorgensen (2002) shows a positive effect of mean nonfinancial income on risk asset market participation. Using the U.S. data, Poterba and Samwick (2002) suggest that marginal tax rates affect households' asset allocation decisions. Rooij et al. (2011) show that individuals with low literacy have a lower probability of investing in stocks.

The second branch examines the relationship between homeownership and risky financial assets holding. Previous studies show how housing investment and homeownership affect households' portfolio choices. Among these studies, a brief review finds that the literature favors the substitution effect instead of the diversification effect. For example, Fratantoni (1998) and Chetty and Szeidl (2010) show that more housing investment leads to less risky asset holdings in the U.S. Flavin and Yamashita (2002) investigate the effects of the portfolio constraint imposed by the consumption demand for housing, namely, the "housing constraint." They show that the aging baby boomers shift their portfolio composition away from bonds toward stocks. Kullman and Siegel (2005) prove that larger real estate exposure leads to a lower likelihood of stock market participation. Cocco (2005) suggests that younger and poorer households have limited wealth to invest in stocks because they invested in housing, and house price risk crowds out stock holdings. Cho (2014) examines the housing effect in multiple European countries and finds that homeowners have a low probability of holding stocks in bank-based economies, but this effect is insignificant in market-based economies. The crowd-out effect of homeownership is significant in areas with low housing supply elasticity (Nam, 2021).

On the contrary, Englund et al. (2002) found that an efficient portfolio does not include housing for short holding periods, whereas low-risk portfolios includes housing for longer periods; this implies that

policies or institutions could get large potential gains. Waggle and Johnson (2009) suggested that households with higher home-to-net worth ratio hold more stock, generally corresponding to younger investors.

There are two possible reasons for the disparities in the findings of previous studies on the effect of homeownership. First, the previous studies use different definitions for homeownership and various specifications. For example, studies have used the predicted homeownership status from a Probit regression (Fratantoni, 1998), the ratio of home value to household wealth (Cho, 2014; Waggle & Johnson, 2009), home equity, and mortgage debt (Chetty et al., 2017). Thus, Chetty et al. (2017) suggest that home equity wealth and mortgage debt have opposite-signed effects on portfolio choice; it is important to isolate their variation. Second, existing studies used different data samples from various countries. Consequently, the contexts of financial and housing markets vary significantly across countries.

3. Data and empirical strategy

3.1. Data and measurement

The present study uses unique data from three separate large-scale surveys in China. The first is the Chinese General Social Survey (CGSS) which comprises three waves of surveys (2010, 2012, and 2013).[1] The second is the China Household Finance Survey (CHFS), covering four waves of surveys (2013, 2015, 2017, and 2019).[2] The third is the China Household Finance Survey (CFPS) which comprises three waves of surveys (2010, 2012, and 2014).[3] The units of observation in the three surveys are individual and household, respectively. All surveys collect rich information on the socioeconomic backgrounds of representative individuals or households in urban China. The three data sets are comparable and complementary.

The CGSS data have over 11,000 individuals' information each year. It includes individuals' personal information about age, gender, level of educational attainment, individual investment choice, and others. We are particularly interested in the respondent's answers to two specific questions in the survey: *(1) Do you hold stock, fund, bond, or other types of financial assets? (The answers are either "Yes" or "No".)*[4] *(2) Who (fully or partially) owns the house in which you live now? (The answers are either*

"Myself," "My spouse," "Children," "Parents," "Parents-in-law," "Spouse of children," or "Others").[5]

We use the CGSS data to examine the relationship between an individual's homeownership status and their choice of risky financial assets holding. We limit the analysis to the urban subsample of the survey too. We focus on the financial decision of people of working ages and then exclude observations of individuals who are older than the retirement age[6] or younger than 18 years old. Furthermore, we delete outliers for the individuals whose annual income is below zero or whose personal annual income is more than the family's annual income.[7] We also delete observations that have missing values for key explanatory variables. Our final sample from the CGSS contains 10,268 observations for the three years.

CHFS data contains 30,000 households each year. The surveys collect information about a household's investment choice. It comes from the question: *Does your family hold stock, fund, bond, or other types of financial assets?* The survey respondent may choose an answer between *"Yes" or "No" and* reports the total monetary value of each type of asset. The survey also asks a question about homeownership and collects information about age, gender, education, and other characteristics of the household and its members. CHFS data allow us to analyze households' decisions of risky financial assets choices. As there are limited rural people who hold risky financial assets or rent a house, we retain the urban subsample of CHFS. We also exclude observations of householders[8] older than the retirement age or younger than 18 years old.

Next, we analyze the research question using the household-level data from CHFS and individual-level data from CGSS and compare the results. We define homeownership in different ways using dummy variables for regression analyses.[9]

Table 1 presents summary statistics for the main variables.[10] The table classifies the individuals (or households) into investors in the risky financial asset markets or non-investors. Other statistics can also be obtained, for example, the individual-level CGSS data and household-level CHFS indicate a homeownership rate of 59 % and 79 %, respectively. For the individual-level CGSS sample, the rate of homeowners participating in the risky financial assets market is 16 %, which is higher than others with a participation rate of 10 %. For the household-level CHFS sample, the participation rate of homeowners is 14.7 %, and 11.7 % for renters.

Compared with non-investors, the ratio of homeownership of investors is 70 %, and is higher than that of non-investors in the CGSS sample. It is also different between investors and non-investors in the CHFS sample.

In the CGSS, investors' education attainment, index of the channels to get news, individual's annual income, and family's total income are higher than those of non-investors. In the CHFS, investor education of the householder, average of family's net income, and total assets are higher than those of non-investors. The difference in the mean values of other variables is almost the same as between investors and non-investors in both CGSS and CHFS.

[1] CGSS is China's first national comprehensive and continuous social survey project. In the first survey of 2003, there were 125 counties (districts), 500 streets (town), 1000 (village) committee, and 10,000 households in the individual investigations. Since 2010, the CGSS started the second phase of the project (2010–2019).
[2] CHFS is aimed at collecting micro-level information on household income, expenses, assets, liabilities, insurance and securities, population, and employment. In 2013, a nationally and provincially representative sample of 28,141 households was collected; in 2015, a nationally, provincially, and sub-provincially representative sample of 37,289 households collected.
[3] CFPS is a nationally representative, annual longitudinal survey of Chinese communities, families, and individuals launched in 2010 by the Institute of Social Science Survey (ISSS) of Peking University, China. CFPS is designed to collect individual-, family-, and community-level longitudinal data in contemporary China. The studies focus on the economic, as well as the non-economic, wellbeing of the Chinese population, with a wealth of information covering such topics as economic activities, education outcomes, family dynamics and relationships, migration, and health. In the 2010 baseline survey, the CFPS successfully interviewed almost 15,000 families and almost 30,000 individuals within these families. The response rate was 79 %.
[4] "Are you real estate speculator" is also asked, and only 13 individuals answered "yes" in CGSS 2010.

[5] There are some individuals or families who own houses but rent elsewhere, for example, renting at a subsidized cost, renting near their children's school or the company, or migrating from other cities where they own houses. Nevertheless, whether they to save on housing is not determined, but we can do a robust test in future to confirm.
[6] Men usually retire at 60 years old and women at 55 years old in China.
[7] "Family" and "household" are interchangeable in the latter parts of this paper.
[8] Householder in CHFS refers to who plays a decisive role in family affairs, not necessarily the head of the household in the household register or the respondent.
[9] In the robustness check, we also define it in another way using a continuous variable.
[10] We have reduced the tail of extreme data by using Winsor size with 5 % and 95 %.

Table 1
Description of variables.

Variable	Description	Non-investor		Investor	
	CGSS (2010,2012 and 2013)	Mean	Std. dev.	Mean	Std. dev.
Homeownership	See note.	0.59	0.49	0.7	0.46
Male	Male = 1, female = 0.	0.56	0.5	0.55	0.5
Age	Individuals' age (year).	40.68	10.24	40.74	9.6
Edu	Level of educational attainment.	2.67	1.02	3.48	0.81
Health	See note.	3.94	0.95	3.93	0.86
Getnews	See note.	2.56	0.7	3.14	0.64
Marriage	Married = 1, else = 0.	0.85	0.36	0.87	0.34
Income	Individual's annual income (10 thousand Yuan).	2.97	5.5	5.88	6.88
Fam_inc	Family's total annual income (10 thousand Yuan).	6.15	8.53	12.22	14.75
Observations		$n = 8881$		$n = 1387$	
	CHFS (2013, 2015, 2017 and 2019)	Mean	Std. dev.	Mean	Std. dev.
Homeownership	See note.	0.79	0.41	0.83	0.38
Male	For the householder, =1 if male.	0.73	0.44	0.69	0.46
Age	Age for the householder.	47.59	11.21	45.73	10.86
Edu	Education years for the householder.	3.80	1.63	5.34	1.66
Marriage	Marriage status for the householder.	0.86	0.34	0.88	0.32
Children	The number of children.	0.85	0.79	0.79	0.64
Health	Health status of householder.	2.58	1.01	2.37	0.88
Inc_net	Average of family's net income (1000 thousand Yuan).	0.03	0.03	0.07	0.05
Asset	Total asset of family (1000 thousand Yuan).	2.98	8.13	11.30	14.76
Observations		$n = 48,328$		$n = 8403$	

Note: 1. Homeownership in the CGSS sample is 1 if the individual (respondent in the survey) and/or their spouse fully or partially owns the house. Homeownership in CHFS is 1 if any family member fully owns the house. 2. The variable for health ranges from 1 to 5, and higher numbers indicate health conditions. 3. For the CGSS data, the education variable is 1 if it is primary school or lower; 2 if junior middle school; 3 if senior middle school; 4 if college; and 5 if above college. We calculate the average score of getting news through channels including "newspapers," "magazines," "radio," "TV," "internet," and "message of the mobile" for each person to measure the variable "getnews". It equals 1 if a respondent presents an answer of "never," 2 if "rarely," 3 if "sometimes," 4 if "often," and 5 if "always."

3.2. Model specification

We use a Probit model to estimate the effect of homeownership on participating in risky financial assets market using the CGSS and CHFS datasets. As the CHFS data contain more relevant variables, we can use a Tobit model to estimate its effect on the total amount of households risky financial assets and its ratio to total assets excluding housing value (Cocco, 2005). The models[11] can be generally written as:

$$y_i^* = x_i^{'}\beta + u_i \qquad (1)$$

where y_i^* is the probability of holding risky financial assets, the total value of the assets, or its share in total household wealth; x_i include homeownership variables, age, education, income, and several other socioeconomic characteristics (Campbell, 2006; Fratantoni, 1998; Guiso

---

[11] The empirical model can be seen as a derivation from the household utility maximization model described by Flavin and Yamashita (2002) and Cho (2014).

et al., 2000; Halko et al., 2012). The error term μ captures other sources of portfolios choice (Chetty & Szeidl, 2010), which may contain entrepreneurial risk (Curcuru et al., 2010), mistakes in investment decisions (Calvet et al., 2007; Odean, 1999), or measurement error (Cocco, 2005). It is assumed that $\mu\sim N(0,\sigma^2)$.

In the Probit model, y_i is a dummy variable. It indicates whether a household (or an individual) holds risky financial assets or not:

$$y_i = \begin{cases} 1, y_i^* > 0 \\ 0, y_i^* \leq 0 \end{cases} \qquad (2)$$

In the Tobit model, y_i is the total (ratio) risky financial assets of a household:

$$y_i = \begin{cases} y_i^*, y_i^* > 0 \\ 0, y_i^* \leq 0 \end{cases} \qquad (3)$$

The sample selection problem exists in our data because many households do not participate in the risky financial assets market. Furthermore, the above models may omit important variables that impact individuals' investment decisions, thus the ordinary Probit or Tobit estimates might be biased (Cho, 2014). We address the endogeneity bias by using the IV. We use the supply of land for commercial use in the city as the IV. This idea follows that of Chetty et al. (2017) on the supply side of the housing. The supply of land is an important reason for the housing price increase, but strictly controlled by the central government and does not directly affect an individual's portfolio choice.

4. Empirical results

We begin this section by reporting results from applying the econometric models to the individual-level CGSS data, and then focus on the household-level by using CHFS and CFPS data.

4.1. Evidence from individual-level data

We explore individuals' risky financial assets market participation using the IVProbit model. The dependent variable is a dummy variable indicating whether an individual holds any risky financial assets (stock or mutual fund). To address the concern of endogeneity, we use the supply of land for commercial use at the city level as the IV. The first-stage regressions for homeownership exhibit the IV reasonable fit in the sample. Table 2 reports the estimated coefficients.

The estimates of homeownership indicate the difference between the homeowners' portfolio choice and the others. Homeownership in Column 1 is set to be one if the individual and/or their spouse owns the house. In Column 2, it equals one if any member(s) of the family owns the house. The IV estimates indicate a negative impact of homeownership, defined as owning the house by the individual.

Column 2 is our preferred specification. It presents IV estimates when homeownership is defined as whether any household member (including the individual) owns the house. The definition was widely used in previous studies such as by Fratantoni (1998) and Coulson and Li (2013). It serves our research purpose better than the other definition. Many individuals in the data sample are young people who live in their parents' houses. Consistent with findings from the household-level CHFS data, the regression finds a negative impact of homeownership on the possibility of participating in the risky financial assets market. It is statistically significant at the 1 % level. The coefficient from the individual-level data is similar in absolute value to household level by using CHFS data. The estimated coefficient indicates that homeowners have a lower probability of investing in the stock and fund markets. The crowd-out effect is similar to that of countries with underdeveloped mortgage markets like Spain, which is weaker or does not exist in financially developed countries such as Italy and Sweden (see Cho, 2014).

Other estimated coefficients from regressions in Table 3 deserve

Table 2
Pool data estimates of CGSS.

Variable	(1)	(2)
	IVProbit	IVProbit
	ownself	ownfamily
Male	−0.063**	−0.048*
	(0.025)	(0.025)
Age	0.126***	0.056***
	(0.009)	(0.010)
Age square	−0.001***	−0.000***
	(0.000)	(0.000)
Education	0.126***	0.167***
	(0.028)	(0.027)
Health	0.032**	0.013
	(0.014)	(0.014)
Getnews	0.118***	0.175***
	(0.038)	(0.036)
Marriage	0.469***	0.264***
	(0.036)	(0.036)
Income	0.010*	−0.015***
	(0.005)	(0.006)
Income square	−0.000*	−0.000
	(0.000)	(0.000)
Fam_inc	0.011***	0.017***
	(0.004)	(0.004)
Fam_inc square	−0.000***	−0.000***
	(0.000)	(0.000)
Homeownership	−2.208***	−2.347***
	(0.050)	(0.063)
Year FE	Yes	Yes
	The first stage	
Land supply	*0.004**	*0.005***
	(0.002)	(0.002)
Observations	8984	8984

Note: 1. In Column 1, homeownership is one if the individual (respondent in the survey) and/or their spouse own/s the house. In Column 2, it is defined based on whether the house is owned by any family members (including the respondent). 2. Standard errors in parentheses.

*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

mention. An individual's risky financial assets market participation is strongly influenced by the individual's characteristics such as gender, age, educational attainment, health condition, access to news and information, personal income, and total household income. The estimation results find that female respondents are more likely to participate. An inverted U-shaped curve is found for the relationship between age and individuals' participation probability. The inverted U-shape was also confirmed by previous studies on China. A higher level of educational attainment is positively associated with a higher probability of participation. An inverted U-shaped curve is also found for the relationship between annual individual annual income (annual household income) and individual probability of investing in risky financial assets. Individuals with greater access to more news and information have a higher probability of participating in markets.

4.2. Evidence from household-level data

The CHFS survey collects data on the monetary value of risky financial assets and the participation status of the households. Thus, we will be able to provide more evidence on the effects of homeownership by using three dependent variables.

Table 3 reports CHFS regression results. The first dependent variable is a dummy variable indicating whether a household holds any risky financial assets (i.e., stock and mutual fund). Control variables include the householder's gender, age, education, marital status, and family's average net income. In addition, the regression also controls the mean values of household members' age and the median level of educational attainment.

Table 3
Pool data estimation of CHFS.

Variable	(1)	(2)	(3)	(4)
	Probit risky assets: probability	Probit risky assets: probability	Tobit risky assets: value	Tobit risky assets: share
Homeownership	0.220***	−0.355***	−18.412***	−0.005***
	(0.027)	(0.031)	(2.300)	(0.000)
Male	−0.110***	−0.099***	−3.915***	−0.000
	(0.017)	(0.017)	(1.315)	(0.000)
Age	8.511***	8.090***	566.981***	0.081***
	(0.846)	(0.859)	(69.452)	(0.013)
Age square	−1.084***	−1.037***	−71.695***	−0.010***
	(0.113)	(0.115)	(9.289)	(0.002)
Edu	1.166***	0.970***	46.914***	0.005***
	(0.024)	(0.024)	(1.919)	(0.000)
Marriage	0.085***	−0.002	−3.050*	−0.001**
	(0.025)	(0.026)	(2.025)	(0.000)
Children	−0.040***	−0.072***	−1.972**	−0.001***
	(0.012)	(0.012)	(0.972)	(0.000)
Health	−0.012	0.024***	0.973	0.000
	(0.008)	(0.009)	(0.669)	(0.000)
Income	0.228***	0.132***	6.702***	0.001***
	(0.008)	(0.008)	(0.672)	(0.000)
Asset		0.352***	20.531***	0.001***
		(0.009)	(0.766)	(0.000)
Year FE	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
Observations	55,286	55,286	50,150	50,150

Note: 1. Homeownership is equal to one if any family member fully owns the house. 2. Standard errors in parentheses.

*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

The CHFS benchmark estimation results are listed in Table 3. In column 1, we use the Probit model to estimate homeownership's effect on risky financial assets investment. We find that homeowners have a higher probability of participating in the risky financial assets market. However, after controlling the household wealth in column 2, homeownership significantly reduces the probability of participating in the risky financial assets market. This finding is consistent with Chetty et al. (2017) and theoretical research (such as Brueckner, 1997; Chetty & Szeidl, 2007). As Chetty et al. (2017) points out, missing variables may lead to a biased estimation of homeownership and are the main reason for the deviation between empirical and theoretical research of the homeownership crowd-out effect. Therefore, household wealth is a critical factor for the estimation of homeownership, and the results from the household-level CHFS data suggest a crowd-out effect of homeownership on the probability of holding any risky financial assets.

The second dependent variable from the CHFS data is the total monetary value of risky financial assets of the household—Column 3 of Table 3 presents regression results from using it. The Tobit estimates show that homeownership's effect on households' total value of risky financial assets is statistically significantly negative. The third dependent variable is the ratio of the total monetary value of risky financial assets to total household wealth (excluding housing value). The estimates from the Tobit model (Column 4) indicate that homeownership has a negative impact on the share of risky financial assets too.

The results show that other factors strongly affect households' risky financial assets market participation. The estimated coefficients suggest that families with married, high educated, or healthier householders are more likely to participate in the risky financial market. In addition, families with a higher net income are more likely to participate in the financial market. However, the probability of participating in the risky financial market is lower for families with a male heading the household or who have more children. The relationship between age and the probability of participating in the risky financial market is an inverted U-shape.

After controlling for family wealth, the homeownership shows a crowd-out effect on risky financial assets investment. We use the instrumental variable method to quantify this effect, as Chetty et al. (2017) suggests. The instrumental variable of homeownership is the supply of land for commercial use in the city where the family is located. Table 4 reports the regression results. The first stage estimation results show that the supply of land for commercial use has a significant positive impact on homeownership. The estimation results of instrumental variables show that homeownership has a significant crowd-out effect on risky financial assets investment. Households with homeownership have a lower total monetary value of risky financial assets and a lower ratio of total monetary value. Therefore, the instrumental variables estimations show that the effect of homeownership is negative and statistically significant.

In sum, the household-level CHFS data also present a crowd-out effect of homeownership on holding risky financial assets, as indicated by the individuals-level CGSS data. This is true for the households when they decide whether to participate in the risky financial assets market and the amount to be invested in it.

4.3. Robustness test

4.3.1. Panel data estimates

A household's portfolio choice can also be affected by other factors. Our previous estimations do not control household-level unobservable variables which may affect a household's decision. The CFPS[12] and CHFS data allow us to use panel data model to analyze a household's choice as the surveys have identification codes for households over the years.

Column 1 of Table 5 reports regression results of CFPS with fixed effect (FE) models. A Hausman test suggests that the FE model is more appropriate for our data. The estimated coefficients from the FE model indicate that homeownership has a significant and negative effect on participating in the risky financial assets market, which confirms the crowd-out effect. Then, we use panel data of CHFS 2013 to 2019 to identify this effect. Column 2 to 4 of Table 5 reports the results of homeownership on risky financial assets participation, value, and share. Again, the estimates of panel data are also significant and negative, showing the existence of the crowd-out effect.

Table 4
Pool data estimation of CHFS (IV).

Variable	(1)	(2)	(3)
	IV-Probit	IV-Tobit	IV-Tobit
	Risky assets: probability	Risky assets: value	Risky assets: share
Homeownership	−2.853***	−7.349**	−0.045**
	(0.427)	(2.962)	(0.018)
Control	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Province FE	Yes	Yes	Yes
	The first stage		
Land supply	0.004***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)
Observations	52,261	47,196	47,196*

Note: 1. Homeownership is equal to one if any family member fully owns the house. 2. Standard errors in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

Table 5
Panel data estimates (CFPS and CHFS).

	(1)	(2)	(3)	(4)
	Risky assets: probability	Risky assets: probability	Risky assets: value	Risky assets: share
Homeownership	−0.646**	−0.247*	−0.017**	−0.0001**
	(0.256)	(0.143)	(0.008)	(0.000)
Observations	1075	2398	43,123	43,123***

Note: 1. The control variables are almost the same as those reported earlier. 2. Standard errors in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

4.3.2. Changing the definition of risky assets

Table 6 reports the robustness checks. First, we test whether the results would change when altering the composition of risky financial assets. While limiting the risky financial assets to stock only, Table 6 presents the IV estimates for the CGSS (Column 1) and CHFS (Columns 2, 3, and 4) data by using the same IVs. The estimated coefficient for homeownership in Column 1 is statistically significant and negative, and compared to that in Column 3 of Table 6, the absolute value of the coefficient becomes slightly larger in magnitude. The interested coefficients in Columns 2, 3, and 4 are significant and negative. Again, all estimated coefficients in this check indicate that homeownership crowds-out investment in risky financial assets.

4.3.3. Changing the definition of homeownership

Homeownership could be defined in other ways in our data. The check for CGSS data presented in Column 1 of Table 7 uses a broader definition; a value of one if any family member owns the house or it is borrowed from friends for free. The estimate for homeownership in this column can be interpreted as the difference in the probability of risky financial assets market participation between renters and non-renters.

House net values are different across households despite the location or the quality of houses being similar. We attempted to define a new independent variable by using house net value (house value minus house debt) instead of homeownership (as Chetty et al., 2017). Table 8 presents the effect of house net value on households' portfolio choice. House net value reduce the possibility of participating in the risky financial assets market significantly, thus high house net value crowds-out risky financial assets. However, it also means that households with less house net value (for example with more house debt) are more likely to hold risky financial assets. In contrast to the homeownership dummy variable estimation, the effects of house net value on total value of risky financial assets are negative and insignificant, but the effects of house

Table 6
Stock as the only risky asset.

Variable	CGSS		CHFS	
	Stock: probability	Stock: probability	Stock: value	Stock: share
	(1)	(2)	(3)	(4)
Homeownership	−2.354***	−2.853***	−7.349**	−0.045**
	(0.059)	(0.427)	(2.962)	(0.018)
Observations	8953	52,261	47,196	47,196*

Note: 1. Homeownership in CGSS is one if the house is fully or partially owned by any family members (including the householder). Homeownership in CHFS is equal to one if any family member fully owns the house. The IV estimates of the homeownership dummy variable are almost the same as those reported earlier. 2. Standard errors in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

---

[12] As the CFPS data does not include the city name, we are not able to use the commercial use land supply on the city level as an IV, but only use CFPS to conduct the robustness check.

Table 7

Different definitions of homeownership.

Variable	CGSS		CHFS	
	(1)	(2)	(3)	(4)
	Risky assets: probability	Risky assets: probability	Risky assets value	Risky assets share
Homeownership	−2.381***	−2.172***	−5.503***	−0.034**
	(0.065)	(0.369)	(2.134)	(0.013)
Observations	8984	52,262	47,197	47,197*

Note: 1. Homeownership in the CGSS and CHFS is one if any family member owns the house or it is borrowed from friends for free in Column 1. 2. Standard errors in parentheses.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

Table 8

The effects of house value.

Variable	(1)	(2)	(3)
	Risky assets: probability	Risky assets: value	Risky assets: share
House net value	−0.964***	−4.676	−0.029*
	(0.032)	(2.867)	(0.017)
Observations	42,159	38,359	38,359**
	(4)	(5)	(6)
	Risky assets: Probability	Risky assets Value	Risky assets Share
House value share	−0.319***	−11.441***	−0.002***
	(0.025)	(1.226)	(0.000)
Observations	44,997	41,108	41,108

Note: 1. Homeownership is equal to the ratio of house value to family's total net wealth 2. Standard errors in parentheses.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

net value on share of risky financial assets are negative and significant.

In addition, we attempted to define a new independent variable, which is equal to the ratio of house value to family's total net wealth instead of the previous dummy variables in the CHFS (as Waggle & Johnson, 2009; Cho, 2014). Table 8 presents the result. Qualitatively, the same results are obtained regarding the impact on total value and share of risky financial assets; a higher ratio of house value is associated with a lower probability of holding the risky financial assets and a lower value and share of the risky financial assets.

As there are different kinds of homeownership in urban China, some households jointly own their houses with their organizations or the local governments and other households obtain the property rights by the welfare-oriented housing distribution rather than from the real estate market. We use three kinds of samples with different ownership to test the crowd-out effect of homeownership (Table A2). First, the estimation results of households who have all property ownership rights of their houses or do not have homeownership show a crowd-out effect of homeownership on risky financial assets market, and the estimators are almost the same as the total household samples. Second, excluding households who obtain the property rights by welfare-oriented housing distribution, the crowd-out effect is also found. Third, excluding households who obtain the property rights by welfare-oriented housing distribution and own their houses jointly with their organization or the government, homeownership has a negative effect on risky financial assets holding too.

4.4. Heterogeneity analysis

The previous studies found that the crowd-out effect of

homeownership is higher for low financial net worth (Cocco, 2005). When the interaction term between family assets and homeownership is added to the model, we found the heterogeneity of the homeownership crowd-out effect. The interaction term between family assets and homeownership is significantly positive (Column 1 in Table 9), indicating that the more the family wealth, the lower the crowd-out effect is. It is consistent with Cocco (2005). At the same time, families with more wealth invest more in risky financial assets (Column 5), but the share of risky financial assets is lower for wealthier homeowners (Column 9). Wealthy families invest more in risky financial assets, but they also invest more in other non-risky assets (like housing), showing the characteristics of diversification.

As ownership of stocks is more attractive to older households that have accumulated more wealth and therefore reduced their ratio of housing to net worth (Flavin & Yamashita, 2002), the crowd-out effect of homeownership may vary depending on householders' ages. Therefore, by examining the interaction term between homeownership and householders' ages, we can analyze the age heterogeneity of the crowd-

Table 9

Heterogeneity across households.

	(1)	(2)	(3)	(4)
Variable	Probability	Probability	Probability	Probability
Homeownership	−0.737***	−0.331	−0.381***	−0.054
	(0.070)	(0.340)	(0.036)	(0.084)
*owner * asset*	0.111***			
	(0.018)			
*owner * age*		−0.007		
		(0.092)		
*owner * buy-in5Y*			0.185***	
			(0.059)	
*owner * propensity*				−0.073***
				(0.022)
Observations	55,286	55,286	55,286	42,351

	(5)	(6)	(7)	(8)
Variable	Value	Value	Value	Value
Homeownership	−44.228***	−33.645	−21.752***	−3.089
	(6.336)	(27.031)	(2.727)	(6.337)
*owner * asset*	6.668***			
	(1.543)			
*owner * age*		4.125		
		(7.296)		
*owner * buy-in5Y*			13.298***	
			(4.257)	
*owner * propensity*				−3.849**
				(1.778)
	(83.829)	(84.063)	(83.699)	(99.754)
Observations	50,150	50,150	50,150	37,922

	(9)	(10)	(11)	(12)
Variable	Share	Share	Share	Share
Homeownership	0.001	−0.005	−0.005***	−0.008***
	(0.001)	(0.005)	(0.000)	(0.001)
*owner * asset*	−0.002***			
	(0.000)			
*owner * age*		−0.000		
		(0.001)		
*owner * buy-in5Y*			0.001*	
			(0.001)	
*owner * propensity*				0.001***
				(0.000)
Observations	50,150	50,150	50,150	37,922

Note: Standard errors in parentheses.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

out effect. However, the coefficient estimate of this interaction term shows that there is no significant difference in the crowd-out effect of homeownership between old and young householders (Column 2) despite the dependent variable being investment probability, the total monetary value, or the share of risky financial assets. By comparing the total assets and average family income between young householders (young than 45 years old) and older householders (older than 45 years old), we found that young householders' mean total assets and average family income are higher than those of the older householders. This potentially explains why the interaction term estimator is not significant.

In CHFS, 12 % of homeowners plan to purchase a house in the next five years, and their portfolio choice may be different from others. We estimated the interaction term between homeownership and the dummy variable of whether the respondent wants to purchase a house in the next five years (buy-in5Y is defined as one if they want to purchase a house in the next five years, and zero if otherwise). We found that the crowd-out effect of homeownership on risky financial assets investment is smaller for house owners who want to purchase an additional house in the next five years (Column 3). Homeowners with a house purchase plan in the future are more likely to participate in the risky financial assets market and invest more (Column 7). The interaction term estimator of the ratio of total monetary value of risky financial assets shows no significant effect, indicating that the ratio of the total monetary value between these two kinds of house owners is insignificant (Column 11). The possible reason is that families that want to purchase new houses in the next five years are wealthier families, as the average total asset of these families is higher than that of the other homeowners.

Risk-taking attitude is an important factor in the decision-making of risky financial assets. Further, we consider the moderation effect of the householder's risk-taking attitude on the homeownership crowd-out effect. The CHFS asked the respondent to state the kind of investment they would make if they had funds; and if the respondent chose high risk investment options the value of risky financial assets investment propensity variable was higher. We found that the crowd-out effect mainly occurs in the families with a higher risky financial assets investment propensity (Column 4). Homeowners with higher risky financial assets investment propensity are less likely to invest in risky financial assets, and their total monetary value of risk assets is lower (Column 8); however, their ratio of the total monetary value of risky financial assets is higher than that of other householders (Column 12). Householders with higher risky financial assets investment propensity have a lower risky financial assets investment value and a higher investment proportion, which indicates that the total assets of such households are lower too.

Chinese regional economic development has an obvious gap, especially among the eastern, central, and western regions. Moreover, the development of the real estate market and financial market in different regions are inconsistent. The crowd-out effect of homeownership on risky financial assets may be heterogeneous among regions. The subregional estimates show that the crowd-out effects exist in eastern, central, and western regions (Table A3), and the probability of holding risky financial assets of house owners in the central region is lower than in the eastern and western regions. Although homeownership has a negative effect on the value and share of risky financial assets, the estimators are only significant in the western region of China at the 5 % level. Therefore, the crowd-out effect of homeownership on risky financial assets is different in the three regions.

The CHFS data we used include survey years 2013, 2015, 2017, and 2019, and could indicate how the impact of homeownership on risk financial assets changes over years. We run the regressions separately once for each year to examine evolution of the crowd-out effect over the years (Table A4). The crowd-out effect is significant in the regressions for each year, but the estimators are different. Overall, the crowd-out effect on the probability increases over the years, the highest being in 2019. The possible reason is the house price changes in the Chinese real estate market. For example, housing prices began to fall in 2014 and

then rose again between 2015 and 2019, resulting in changes in households' choice of housing and financial assets.

4.5. Mechanism analysis

4.5.1. Liquidity constraints

As housing is an illiquid asset, it is relatively more costly to adjust. Therefore, homeowners may face more liquidity constraints than house renters. This may be due to two reasons: first, homeowners may have mortgage commitment risks; and second, homeowners have fewer liquid assets. Investigating the effect of homeownership on household debts demonstrated that homeownership has no significant effect on household debt (Column 1 in Table 10). As a result, there are certain differences between the Chinese homeowners and those in other countries; the higher the family debt, the higher the probability of participating in the risky financial assets market (Column 2). Further, we investigate the effect of house debt on risky financial assets investment directly, and find that house debt has a positive effect on risky financial assets holding. The possible reason is that there are only approximately 13 % homeowners with house debt in China, and families with higher debt tend to have stronger debt repayment ability (higher average income) and higher total wealth in China, thus the mortgage commitment risk of homeowners is not an important measure of the crowd-out effect. The mortgage commitment risk is not the main mechanism for the homeownership crowd-out effect.

From identifying the relationship between homeownership and household liquidity assets, we find that homeowners have lower liquid assets (Column 3) because they face more liquidity constraints than others, and illiquidity of housing amplifies household risk aversion (Chetty et al., 2017). Simultaneously, the probability of a household participating in the risky financial assets market is higher in the family with more liquid assets (Column 4). Therefore, liquidity constraint rather than the debt is an important mechanism for the homeownership crowd-out effect.

4.5.2. Risk preference

Housing is thus driven by dual consumption and investment motives, and portfolio inefficiency can be seen as the result of a rational balancing (Brueckner, 1997). If risky financial assets investment results from rational family choice, then the risk preference affects households'

Table 10
Mechanism analysis: liquidity constraints.

Variable	(1) Debt	(2) Risky assets: probability	(3) Liquidity asset	(4) Risky assets: probability
Homeownership	−23.893 (44.475)		−13.340** (5.640)	
Debt		0.022*** (0.001)		
Liquidity asset				0.119*** (0.001)
Observations	29,325	26,297	43,260	41,688*

Note: Standard errors in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

portfolio choice. Risk taking families may be more likely to participate in the risky financial assets market. Whether a family owns a house will affect the family's ability to bear risks, as the house owner be pressured

to repay the loan or insufficient liquidity. Therefore, risk preference[13] may be one of the homeownership crowd-out effect mechanisms. By analyzing the impact of homeownership on risk preference, we find that homeowners are more cautious in risky financial assets investments (Table 11). The estimated results of the Probit model are consistent with the IVs estimators.

4.5.3. Diversification effect

Although homeownership tends to significantly crowd out risky financial assets, there are straightforward differences among home-owners; some families own multiple houses while others own just one. For families with only one house, the drive-by consumption is higher than the investment motives of owning a house, but for families with multiple houses, the surplus house could be for investment motives. Therefore, the diversification tendency of family risky financial assets can be identified by the number of family houses.

We define a dummy variable (Multiple houses) to investigate whether a family owning more than one house has a diversification effect. It is defined as one if a family owns more than one house, and zero otherwise. We find that owning only one house has a significant crowd-out effect on risky financial assets investment, but the crowd-out effect of families with more than one house is smaller (Column 1 in Table 12). Moreover, a house purchase restriction and land supply in the city where the family is located are IVs for these two kinds of homeownerships. Since 2011, 46 cities in China have imposed restrictions on house purchases, mainly on the number of homes purchased by families. Urban house purchase restriction measures are relatively exogenous to families but will significantly affect the number of houses purchased by urban families. The IV estimators in Column 2 show that families with more than one house have a higher probability of participating in risky financial assets investment than others, which means they tend to diversify their financial assets. Therefore, the diversification effect exists in families with more than one house.

5. Conclusion

Theoretical studies have found that housing has a crowd-out effect on risky financial assets investment. However, many empirical studies that do not consider the missing variables and household debt made inconsistent conclusions based on theoretical studies. Using CGSS data, CHFS data, and CFPS data, this study tests the crowd-out effect of

Table 11
Mechanism analysis: risk preference.

Variable	(1) Probit	(2) IVProbit
	Risk preference	Risk preference
Homeownership	−0.093***	−1.605*
	(0.026)	(0.838)
		First stage
Land supply		0.004***
		(0.001)
Observations	41,195	38,970**

Note: Standard errors in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

Table 12
Mechanism analysis: diversification effect.

Variable	(1)	(2)
	Risky assets: probability	Risky assets: probability
	Probit	IVprobit
Homeownership	−0.366***	−1.728***
	(0.031)	(0.436)
Multiple houses	0.053***	2.034***
	(0.019)	(0.697)
	The first stage	
	Homeownership	Multiple houses
Land supply	0.002***	−0.001**
	(0.001)	(0.001)
Purchase restriction	−0.107***	−0.030***
	(0.003)	(0.004)
Observations	55,021	52,007*

Note: Standard errors in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

housing on risky financial assets investment and finds that China's homeowners have a lower probability of participating in the risky financial assets market than those who do not own a house. This is confirmed by both individual-level and household-level data from three recent surveys. All else being equal, the homeowners also hold fewer risky financial assets. The results are consistent across various specifications of the empirical models with different definitions of homeownership.

Further, the crowd-out effect of homeownership on household risky financial assets investment is heterogeneous. Wealthy families have a smaller homeownership crowd-out effect. Moreover, the crowd-out effect of homeownership is also smaller for homeowners with a five-year house purchase plan. However, for risk-averse families, the crowd-out effect of homeownership is greater. In sum, the heterogeneity of these crowd-out effects of homeownership is related to the level of family wealth. The probability of holding risky financial assets of homeowners in the central region is lower than in the eastern and western regions of China. Over the years, the crowd-out effect of homeownership on the probability of holding risky financial assets is larger.

More importantly, Chinese families' homeownership has a crowd-out effect on risky financial assets investment, but the mechanism is different in other countries. As Chinese households with higher debt have higher assets, household debt or mortgage commitment risk is not the main reason for the crowd-out effect. The mechanism for the crowd-out effect on risky financial assets is that housing reduces the liquidity of household assets, while liquidity constraints crowd out household risky financial asset investment. Moreover, although homeownership generally crowds out the risky financial assets investment of Chinese households, households with multiple houses still have a diversified characteristic of portfolio choice.

In general, this study confirms that the crowd-out effect of homeownership exists in China's financial asset market. However, due to the different distribution characteristics of household wealth and debt among China and other countries, the mechanism of the crowd-out effect is not mortgage commitment risk but liquidity constraint. Furthermore, wealthy families with multiple houses tend to diversify their financial assets. As the proportion of household housing assets in Chinese households is extremely high leading to liquidity constraints, restraining the urban housing price bubble to reduce the share of housing assets could be important in promoting further development of China's financial market. Additionally, controlling the risks in the financial market is an important measure to encourage households to holding risky financial assets.

There are some limitations of the present study. First, as CHFS and CGSS have different information on individuals and households, we

---

[13] Risk preference is defined by the question "If you have two lottery tickets to choose; for the first one, you have a 100 % chance of winning 4000-yuan RMB, for the second, one you have a 50 % chance of winning 10,000-yuan RMB and a 50 % chance of winning nothing. Which one would you like to choose?" Risk preference is defined as one if they choose the second option, and zero if otherwise.

focus on whether the estimators of homeownership in CGSS and CHFS are consistent or not, but do not compare the effect of each of the control variables between these two data. Second, the crowd-out effect exists both at the individual and household levels, identifying the difference between individual level and household level is difficult. Third, explaining the causes of year change of crowd-out effect is difficult, and this can be included in a future study.

CRediT authorship contribution statement

Sanbai Sun: Conceptualization, Methodology, Software, Writing-Original draft preparation, Writing- Reviewing and Editing.
Chunhua Wang: Conceptualization, Writing- Original draft preparation, Writing- Reviewing and Editing.
Yan Zhang: Data Curation, Investigation.
Ding Li: Data curation, Software.
Chu Wei: Supervision, Validation, Writing- Reviewing and Editing.

Declaration of competing interest

The author declares that (s)he has no relevant or material financial interests that relate to the research described in this paper.

Data availability

All data are publicly accessible. We have introduce the detailed information for data sources in the footnotes.

Appendix A

Table A1
Description of variables.

Variable	Description	Non-investor		Investor	
	CFPS (2010, 2012 and 2014)	Mean	Std. dev.	Mean	Std. dev.
Homeownership	See note.	0.81	0.39	0.81	0.39
Male	for the householder, =1 if male.	0.68	0.47	0.59	0.49
Age	for the householder.	46.17	8.86	46.06	8.87
Edu	for the householder. See note.	3.07	1.24	4.21	1.22
Marriage	for the householder, =1 if married.	0.90	0.30	0.92	0.28
Health	See note.	3.45	1.25	3.56	1.12
H-age	Average of family members' age (year).	36.86	9.95	38.26	9.45
H-AgeGap	Gap of family members' age (year).	33.91	18.38	31.87	16.61
H-edu	Median level of education.	2.98	1.06	4.04	1.04
Inc_net	Average of family's net income (10 thousand Yuan).	1.39	2.08	3.14	4.39
T_asset	Total asset of family (10 thousand Yuan).	44.4	310.3	124.40	174.0
H-Business	=1 if engaged in business.	0.12	0.32	0.10	0.30
Observations		$n = 10{,}125$		$n = 1260$	

Note: 1. Homeownership in this CFPS equals one if any family member fully owns the house. 2. The education variable equals to 1 if primary school or lower, 2 if junior middle school, 3 if senior middle school, 4 if college, 5 if above college. The variable for health ranges from 1 to 5 and higher numbers indicate health conditions.

Table A2
Samples with different kinds of homeownership.

Variable	Samples I		
	(1)	(2)	(3)
	Risky assets: probability	Risky assets: value	Risky assets: share
Homeownership	−3.045***	−6.253**	−0.038**
	(0.303)	(2.788)	(0.017)
Observations	42,270	38,630	38,630

Variable	Samples II		
	(4)	(5)	6)
	Risky assets: probability	Risky assets: value	Risky assets: share
Homeownership	−2.734***	−7.665**	−0.048**
	(0.458)	(3.075)	(0.019)
Observations	49,137	44,581	44,581

Variable	Samples III		
	(7)	(8)	(9)
	Risky assets: probability	Risky assets: value	Risky assets: share
Homeownership	−2.970***	−6.364**	−0.040**
	(0.309)	(2.827)	(0.017)
Observations	39,324	36,162	36,162*

Note: 1. Samples I are households who own the whole property rights or renters. Samples II are households who did not obtain the property rights by welfare-oriented housing distribution or renters. Samples III are households who own the whole property rights and did not obtain the property rights by welfare-oriented housing distribution or renters. 2. Homeownership is equal to one if any family member fully owns the house. 3. Standard errors in parentheses.

*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

Table A3
Heterogeneity across regions.

Variable	Eastern of China		
	(1)	(2)	(3)
	Risky assets: probability	Risky assets: value	Risky assets: share
Homeownership	−2.994***	−5.335	−0.031
	(0.678)	(4.007)	(0.024)
Observations	27,059	23,608	23,608

Variable	Central of China		
	(4)	(5)	6)
	Risky assets: probability	Risky assets: value	Risky assets: share
Homeownership	−3.547***	−28.637	−0.186
	(0.043)	(21.512)	(0.138)
Observations	13,309	12,488	12,488

Variable	Western of China		
	(7)	(8)	(9)
	Risky assets: probability	Risky assets: value	Risky assets: share
Homeownership	−3.018***	−68.548**	−0.445**
	(0.325)	(27.246)	(0.191)
Observations	11,893	11,100	11,100*

Note: 1. Homeownership is equal to one if any family member fully owns the house. 2. Standard errors in parentheses.

*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

Table A4
Heterogeneity across years.

Variable	2013		
	(1)	(2)	(3)
	Risky assets: probability	Risky assets: value	Risky assets: share
Homeownership	−1.574***	−2.124***	−0.014***
	(0.308)	(0.704)	(0.005)
Observations	7468	7210	7210

Variable	2015		
	(4)	(5)	6)
	Risky assets: probability	Risky assets: value	Risky assets: share
Homeownership	−2.924***	−7.513**	−0.045**
	(0.043)	(21.512)	(0.138)
Observations	17,964	14,766	14,766

Variable	2017		
	(7)	(8)	(9)
	Risky assets: probability	Risky assets: value	Risky assets: share
Homeownership	−2.804***	−6.667**	−0.040**
	(0.325)	(27.246)	(0.191)
Observations	14,320	13,297	13,297

(continued on next page)

Table A4 (*continued*)

Variable	2017		
	(7)	(8)	(9)
	Risky assets: probability	Risky assets: value	Risky assets: share

Variable	2019		
	(10)	(11)	(12)
	Risky assets: probability	Risky assets: value	Risky assets: share
Homeownership	−3.420***	−12.147**	−0.070**
	(0.325)	(27.246)	(0.191)
Observations	13,623	13,007	13,007*

Note: 1. The instrument variable used is the land supply of affordable housing on the city level. 2. Homeownership is equal to one if any family member fully owns the house. 3. Standard errors in parentheses.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

References

Aratani, Y. (2005). Does suburbia residence still matter? The effect of growing up in single-family private house on housing tenure of. http://fugu.ccpr.ucla.edu/publications/conference-proceedings/CP-05-068.pdf.

Brueckner, J. K. (1997). Consumption and investment motives and the portfolio choices of homeowners. *Journal of Real Estate Finance and Economics, 15*(2), 159–180.

Calvet, L. E., Campbell, J. Y., & Sodini, P. (2007). Down or out: Assessing the welfare costs of household investment mistakes. *Journal of Political Economy, 115*(5), 707–747.

Campbell, J. Y. (2006). Household finance. *Journal of Finance, 61*(4), 1553–1604.

Chetty, R., & Szeidl, A. (2007). Consumption commitments and risk preferences. *Quarterly Journal of Economics, 122*(2), 831–877.

Chetty, R., & Szeidl, A. (2010). *The effect of housing on portfolio choice. NBER working paper no. 15998*.

Chetty, R., Sándor, L., & Szeidl, A. (2017). The effect of housing on portfolio choice. *The Journal of Finance, Lxxii*(3), 1171–1210.

Cho, I. (2014). Homeownership and investment in risky assets in Europe. *Review of European Studies, 6*(4), 254–267.

Cocco, J. F. (2005). Portfolio choice in the presence of housing. *Review of Financial Studies, 18*, 535–567.

Coulson, N. E., & Li, H. (2013). Measuring the external benefits of homeownership. *Journal of Urban Economics, 77*, 57–67.

Curcuru, S., Heaton, J., Lucas, D., & Moore, D. (2010). Heterogeneity and portfolio choice: Theory and Evidence. In *, 1. Handbook of Financial Econometrics: Tools and Techniques* (pp. 337–382). Elsevier.

Di, Z., Belsky, E., & Liu, X. (2007). Do homeowners achieve more household wealth in the long run? *Journal of Housing Economics, 16*, 274–290.

Dröes, M. I., & Hassink, W. H. J. (2013). House price risk and the hedging benefits of home ownership. *Journal of Housing Economics, 22*(2), 92–99.

Englund, P., Hwang, M., & Quigley, J. M. (2002). Hedging housing risk. *The Journal of Real Estate Finance and Economics, 24*(1/2), 167–200.

Everhardt, S. L. (2014). Meeting the needs of mothers and families? Family self-sufficiency programs and goals of homeownership. *Michigan Family Review, 18*(1), 80–100.

Flavin, M., & Yamashita, T. (2002). Association owner-occupied housing and the composition of the household portfolio. *American Economic Review, 92*(1), 345–362.

Fratantoni, M. C. (1998). Homeownership and investment in risky assets. *Journal of Urban Economics, 44*, 27–42.

Grossman, S. J., & Laroque, G. (1990). Asset pricing and optimal portfolio choice in the presence of illiquid durable consumption goods. *Econometrica, 58*, 25–51.

Guiso, L., Haliassos, M., & Jappelli, T. (2000). *Household portfolios: An international comparison. Working paper no.48*. Center for Studies in Economics and Finance.

Halko, M.-L., Kaustia, M., & Alanko, E. (2012). The gender effect in risky asset holdings. *Journal of Economic Behavior & Organization, 83*(1), 66–81.

Henderson, J. V., & Ioannides, Y. M. (1983). A model of housing tenure choice. *American Economic Review, 73*(1), 98–113.

Kullman, C., & Siegel, S. (2005). *Real estate and its role in household portfolio choice. Working paper*. University of British Columbia.

Lersch, P. M., & Dewilde, C. (2018). Homeownership, saving and financial wealth: A comparative and longitudinal analysis. *Housing Studies, 33*(8), 1175–1206.

Lin, Z., Liu, Y., & Xie, J. (2021). Banking deregulation and homeownership. *Journal of Housing Economics, 52*, Article 101749.

Nam, T. Y. (2021). Geographic heterogeneity in housing market risk and portfolio choice. *The Journal of Real Estate Finance and Economics, 62*(5).

Odean, T. (1999). Do investors trade too much? *American Economic Review, 89*(5), 1279–1298.

Paz-Pardo, G. (2021). Homeownership and portfolio choice over the generations. In *Working paper series*.

Poterba, J. M., & Samwick, A. A. (2002). Taxation and household portfolio composition: US evidence from the 1980s and 1990s. *Journal of Public Economics, 87*, 5–38.

Rooij, M. V., Lusardi, A., & Alessie, R. (2011). Financial literacy and stock market participation. *Journal of Financial Economics, 101*, 449–472.

Tracy, J., & Schneider, H. (2001). Stocks in the household portfolio: A look back at the 1990's. *Current Issues in Economics and Finance, 7*(4), 1–6 (Federal Reserve Bank of New York, New York, NY).

Vissing-Jorgensen, A. (2002). *Towards an explanation of household portfolio choice heterogeneity: Nonfinancial income and participation cost structures. NBER working paper, no w8884*.

Waggle, D., & Johnson, D. T. (2009). Homeownership and mixed-asset portfolio allocations. *The Quarterly Review of Economics and Finance, 49*, 484–500.

Yao, R., & Zhang, H. H. (2005). Optimal consumption and portfolio choices with risky housing and borrowing constraints. *Review of Financial Studies, 18*, 197–239.

Zheng, X., Yuan, Z. Q., & Zhang, X. (2020). Does happiness dwell in an owner-occupied house? Homeownership and subjective well-being in urban China. *Cities, 96*, Article 102404.