How Is Student Loan Debt Associated with Homeownership and Home Equity?

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Presentation Outline

- Introduction
- Literature Review
- Hypothesis
- Methodology
  - Data
  - Dependent and independent variables
  - Data analysis
- Main Results
- Conclusion

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Introduction

- Statistics of student loan debt in the U.S.
  - Average debt for a single year of college is $6,707 (U.S. Department of Education, 2018)
  - Average debt of a 4-year college student is $26,830 (U.S. Department of Education, 2018)
  - Average student loan interest rate is 6.8% (U.S. Department of Education, 2018)
  - There are 44 million Americans having student loan debt, which result in $1.48 trillion in total U.S. student loan debt (Federal Reserve Bank, 2017)

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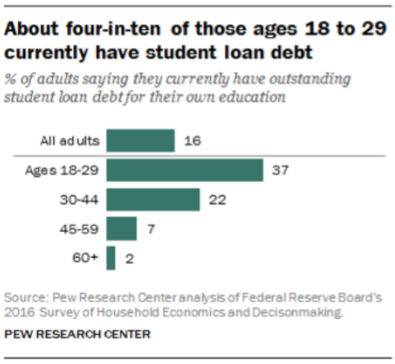
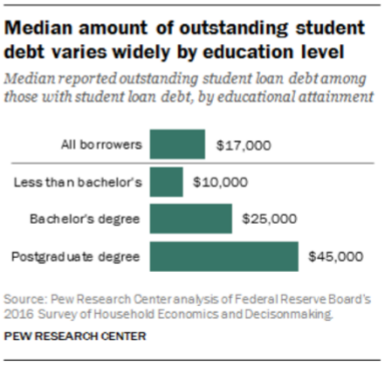
Introduction

- Statistics of student loan in the U.S.





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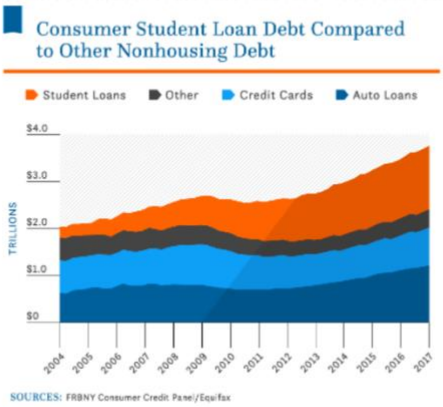
Introduction

- Statistics of student loan in the U.S.



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Introduction

- Previous studies on associations among student loan, homeownership, and home equity
  - A negative relationship between student loan debt and homeownership by analyzing individuals age 25 and 30 (Houle & Berger, 2014)
  - Increasing amounts of student loan debt decreased the rate of homeownership by analyzing individuals age 23 to 31 (Mezza, Ringo, Sherlund, & Sommer, 2017)
  - Student loan debt clearly imposes a significant burden on young households, as loan payments account for approximately 19% of their monthly incomes (Lew, 2015)

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Introduction

- Homeownership in the U.S.
  - Dropped from 67.8% in 2005 to 58.5% in 2015 (U.S. Census Bureau, 2016)
  - Decreased from 47.5% in 2007 to 39.2% in 2015 among those in the 25 to 34 age group (U.S. Census Bureau, 2016)

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Introduction

- Homeownership in the U.S.

Source: U.S. Bureau of the Census.

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Introduction

- Purpose of this study
  - Examine the association between student loan and homeownership and home equity across all age groups
  - Identify factors related to home equity
- Contribution of this study
  - Help students who want to become homeowners in the future to make a more informed decision regarding student loan debt assumption and homeownership
  - Provide implications to students, educators, and financial planners

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Literature Review

- Age factor of homeownership
  - Younger households are less likely to own homes than older households (Myers Jr. & Chung, 1996; Quercia, McCarthy, & Wachter, 2003; Mezza, Ringo, Sherlund, & Sommer, 2017)
  - As people grow older, their probability of homeownership increases as well (Hood, 1999)
  - People below age 30 had higher probability of becoming homeowners than all other age groups (Feijten, Mulder, & Baizán, 2003)

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Literature Review

- Race factor of homeownership
  - White households (69.1%) have a much higher rate of homeownership than Black (14.1%) and Hispanic (12.2%) households (Barakova, Bostic, Calem, & Wachter, 2003)
  - Non-Hispanic households have a higher (70.0%) rate of homeownership than Hispanics (47.3%) (Cortes, Herbert, Wilson, & Clay, 2007)
- Gender factor of homeownership
  - Compared to women, men are less likely to own homes (Myers Jr. & Chung,1996; Hood,1999; Quercia et al., 2003)

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Literature Review

- Education factor of homeownership
  - Evidence showed a positively relationship between education and homeownership (Feijten et al., 2003)
  - A higher education level increases the probability of homeownership (Hood, 1999)
- Marital factor of homeownership
  - Married households are more likely to own homes than single households (Myers Jr. & Chung, 1996; Hood, 1999; Quercia et al., 2003)

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Literature Review

- Employment factor of homeownership
  - Individuals who did not work had much lower probabilities of becoming homeowners than those who work (Feijten et al., 2003; Houle & Berger, 2014)
- Income factor of homeownership
  - Households with higher income are more likely to own homes than low income families (Myers Jr. & Chung, 1996)
- Net worth factor of homeownership
  - Net worth also is associated closely and positively with homeownership (Rosenthal, 2002; Quercia et al., 2003)

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Literature Review

- Student Loan factor of homeownership
  - Studies have found that student loan debt is related negatively to homeownership (Luong, 2010; Brown & Caldwell, 2013; Wang & Cooper, 2014; Houle & Berger, 2015; Mezza, Sommer, & Sherlund, 2014; Mezza et al., 2017)
  - Every $1,000 increase in student loan debt before age 23 decreases the homeownership rate by 0.1% at age 26 (Mezza et al., 2017)
  - 64% of respondents without student loans were homeowners, compared to 53% of them who had student loans (Luong, 2010)

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Literature Review

- Credit rating factor of homeownership
  - Barakova et al. (2003) found that poor credit reduces the likelihood of being a homeowner significantly
  - Cortes et al. (2007) also found that a low credit score deters households from owning homes
- Health factor of homeownership
  - Individuals in poor health are less likely to own homes than those in good and excellent health (Myers Jr. & Chung, 1996)

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rature Review

Literature Review

- Age factor of home equity
  - Studies found older homeowners have greater home equity than younger homeowners do (Myers Jr. & Chung, 1996; Krivo, & Kaufman, 2004)
- Race factor of home equity
  - White homeowners had much higher home equities than Black and Hispanics (Krivo, & Kaufman, 2004)
    - For example, average White homeowners had $92,962 home equities, compared with $37,135 of Black and $48,636 of Hispanics (Krivo, & Kaufman, 2004).

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Literature Review

- Marital factor of home equity
  - Homeowners who have been married for many years have greater home equity than those who have had multiple previous marriages (Myers Jr., & Chung, 1996)
  - Married homeowners had significantly more home equities than unmarried (Krivo, & Kaufman, 2004)

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Literature Review

- Education factor of home equity
  - Myers Jr. and Chung (1996) found that homeowners with bachelor's or graduate degrees have greater home equity than those who had associate's degrees do
  - Krivo and Kaufman (2004) found similar results that individuals with more years of educations had higher home equities than those with few years of education
- Income factor of home equity
  - Individuals with higher incomes have greater home equity than those with low incomes (Myers Jr. & Chung, 1996; Krivo, & Kaufman, 2004)

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Literature Review

- Employment factor of home equity
  - Krivo, & Kaufman (2004) found employment was found positively associated with home equity amount
  - Myers Jr. and Chung (1996) also found that unemployed homeowners have much lower home equity than those who are employed
- Investment horizon factor of home equity
  - Compared to white homeowners who have short investment horizons, those who have long investment horizons accumulated more home equity (Barakova et al., 2003)

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Hypothesis

- H1: Student loan debt is negatively associated with households' homeownership.
- H2: Student loan debt is negatively associated with households' home equity for homeowners.

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Methodology

- Data
  - 2016 Survey of Consumer Finances
  - Total sample size: 6,248
- Sample selection criteria
  - Excluded "other" race group
  - Excluded respondents who did not have at least some college education
  - Final sample size of this study: 3,217

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Methodology

- Dependent variables
  - Homeownership (Yes, No)
  - Home equity (Amount)
- Independent variables
  - Demographic characteristics, including age, gender, race, marital status, education, employment status
  - Financial characteristics, including income, net worth, using financial planner
  - Other characteristics, including investment horizon and health condition

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Methodology

- Data analysis
  - ➢ Heckman (1979) two-step model
    - Step 1: Assessing whether an individual owned a home

$$y_{1i} = \beta_{10} + \beta_{1i}x_{1i} + \varepsilon_{1i}$$

    - Step 2: How much they saved in home equity

$$y_{2i} = \beta_{20} + \beta_{2i}x_{2i} + \lambda + \varepsilon_{2i}$$

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Main Results

- Each year increase in age increased the probability of homeownership by 0.8%.
- Married respondents had a 13.2% greater probability of owning a home than those who were unmarried.
- Respondents with child(ren) had a 5.9% greater probability of homeownership than those who did not have child(ren).
- Households who had been refused credit or were unable to obtain the amount of credit for which they applied had a 5.6% lower probability of owning a home than those who did not.

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Main Results

- Student loan debt was negatively associated with home equity.
- Factors that contributed positively to home equity included age, being married, having a higher education level, household income, net worth (excluding home equity), having child(ren), a longer investment horizon, and good health.

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Conclusion

- Student loan debt has a negative effect on both homeownership and the amount of accumulated home equity.
- Help students who want to become homeowners in the future make an informed decision regarding student loan debt assumption and the amount to borrow.

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Thank You!

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To Buy or To Rent? Evidence from The UK Housing Market
(Extended Abstract)

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Introduction

In recent decades, there is furious debate about whether renting is better than buying a property. Office of National Statistics (ONS) indicates that, on average, house prices have increased by 7% per year since 1980 in the UK. Soaring housing price causes the symptom that people are less likely to buy a house. During 1981 to 2014, house ownership for age group of 16 to 24 reduced from 36% to 9%, and for age group of 35 to 44 reduced from 78% to 59%. This fact highlights that it is more and more difficult for young people to be a house owner. [1] The percentage of young adult householders owning their home decreased from 55% in 1996 to 30% in 2015 for 25 to 29 years old; and from 68% to 46% for 30 to 34 years old. Additionally, in 2015, 91% of householders who aged 20 to 24 were living in rented accommodation, and this number was 70% in 1996. On the other hand, only 9% of 20 to 24 years old householders owned their homes either outright or with a mortgage or loan in 2015, and this figure was 30% in 1996.[2]

Buy-to-let investment is argued as a main and important factor to stimulate the house price soar. Investor could get the maximum 75% of house price from mortgage to buy a property for letting. The rental from the buy-to-let property could be used to repay the mortgage. The buy-to-let investment, therefore, forms up more investment demand and compete with residential house buyer. The stronger demand further pushes up the house price. [3]

Moreover, the sub crime crisis in 2008 considerably hit the UK housing market. The declined house prices were accompanied by less mortgage availability and much stricter lending criteria. All the factors mentioned above lead to a tougher condition for people's property ladder.

This study aims to provide a comprehensive research on the determinants of housing decision, in particular, for renters. We expect to provide an in-depth and profound analysis with robust econometric model for the housing market and policymakers.

Contribution

This study is the first research to document and investigate the renter's housing decision in the UK, and it provides a comprehensive analysis to investigate this issue: we decompose the samples into married/cohabit, single family, Londoner and non-Londoner, and young generation. We examine the factors of renter's housing decision that has not yet been fully explored in the existing literatures. This paper focuses on the renters' house ownership when they reallocate their residency, which provide accurate information to identify the renters' housing decision.

[1] https://visual.ons.gov.uk/uk-perspectives-2016-housing-and-home-ownership-in-the-uk/

[2] https://visual.ons.gov.uk/living-with-parents/

[3] The UK government introduce several policies to slower the house prices. For example, UK government setup more restrict mortgage condition on buy-to-let investment, and introduce the sub-charge/extra stamp duty on the properties which are not used as main residency.

Data

The British Household Panel Survey (BHPS) is a multi-purpose dataset, which covers the period from 1991 to 2008. The BHPS is an annually UK-wide survey: it consisted of around 5,500 households and 10,000 individuals from Great Britain before 1999, 3,000 households more from both Scotland and Wales since 1999, and another 1,900 households from Northern Ireland since 2001. Participants of the BHPS in 2008 were asked if they would consider joining a new and wider-range survey—the UK Households Longitudinal Study (UKHLS), which is conducted by the Understanding Society. Around 80% participants of the BHPS jointed the UKHLS, and many new samples were involved in UKHLS. Therefore, compare with the BHPS, UKHLS has bigger sample size and more detailed questionnaire. This extension allows researchers to investigate participants' long-term behaviour. The UKHLS began in 2009 and is a multi-topic household survey. It collects a wide range of information on many topics, such as employment history, healthy condition, education, lifestyle, etc. This survey is considered as a successor of the BHPS, and its sample size is bigger. The UKHLS consists of around 40,000 households and 100,000 individuals. This paper uses Probit model to investigate people's housing decision with using both BHPS and UKHLS.

The aim of this research is to investigate people's housing decision. The dependent variable is a dummy with indicating whether people buying a property when they re-allocate their accommodation. Given that people have moved home, if people were renter at time *t-1* and owned a property at time *t*, then the value of the variable is 1, otherwise 0. The reallocation from landlord to landlord is excluded from the sample as we focus on how people climb on the property ladder.

Results

This paper reveals several interesting findings on people's decision of buying a property. The effect of age on the probability of buying a property is non-linear, and it is a concave shape. This suggests young people are less likely to afford buying a property. They are at the beginning stage of the career path, therefore their income is not sufficient generally. With accumulating experience and expertise over time, young people's income will grow. Middle-age people have higher possibility to buy a property because, normally, their income have grown to a specific level which allow them to buy a property. Comparing with middle-age people, the possibility of buying a house is reduced for old people as they face the issue of retirement and health, therefore do not have regular and sufficient income anymore. Employed workers have higher possibility to buy a property than unemployed workers. Higher education significantly increases the possibility of buying a property. Women are more willing to buy a property than men. Marriage increases the possibility of buying a property. This implies that marriage/cohabit let people to consider a long-term settlement or residency.

Buying a property become more and more difficult if people have more dependent children. The average house price significantly reduces the possibility of buying a property. A higher household income enhances the possibility of buying a property.

Conclusion and Policy suggestion

This research supports that the soaring house price make the renters' situation worse and more difficult to climb on the property ladder. However, the Brexit will make this situation tougher. The UK house price increase is due to increasing demand and limited supply.[4] The increasing cost of building new house reduces the number of new home, and that exacerbate the tension of housing market. The renters are expected to face the critical situation of climbing property ladder. Furthermore, more and more young adult (20-34 years old) are living with their parents, and the main reason is their financial affordability.[5] This might generate new type of family issue, which we never deal with before. The findings also reveal there are a bunch of young people who even cannot rent an accommodation on their own, therefore the difficulty of climbing property ladder is more severe than we ever expected.

[4] https://visual.ons.gov.uk/uk-perspectives-2016-housing-and-home-ownership-in-the-uk/

[5] https://visual.ons.gov.uk/living-with-parents/

Uncertainty and Household Portfolio: The Hedging Role of Housing Asset

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Abstract

Housing plays an important role in household's investment behaviors under incomplete financial market. However, unlike financial assets, the role of housing asset in household portfolio choice and portfolio efficiency under uncertainty is largely omitted in existing research. Using a comprehensive micro database, this paper investigates the hedging role of housing asset under uncertainty in transition economy like China. Both income uncertainty and uncertainty of human capital expenditure are incorporated; meanwhile, household's asset allocation options and corresponding portfolio efficiency under such uncertainty are studied. Our empirical findings shows that, uncertainty of future expenditure is important in household asset choices and housing plays a significant role in hedging such uncertainty. When face higher income uncertainty, household will decrease the share of housing asset in total asset by increasing safe financial asset (deposit); while facing higher expenditure uncertainty will induce households to decrease the share of housing asset in total asset by purchasing new houses or increasing housing equity (such as moving into bigger houses) and decreasing risky financial investment (such as stock). Finally, including housing as a hedging asset will reduce the stock market participation and thus decreases the portfolio effectiveness of risky assets.

Introduction

Understanding how uncertainty affects household's portfolio choices is the key to capture the mechanisms of household managing risks and have wide welfare implications on stability of financial market. However, existing research on household's asset allocation and portfolio efficiency under uncertainty are mainly focusing on financial assets.

Housing with the dual role of both consumption goods and investment assets plays an important role in household's consumption and investment decisions (Brueckner et al., 1997). It is has been suggested that the inseparability of the consumption and investment demand for housing could induce the homeowner's portfolio of stocks and housing to be mean-variance inefficient, especially under incomplete financial market with high entering cost (Yao and Zhang, 2005). Thus, given the significant interaction between housing asset and financial asset allocation, it is necessary to focus on the role housing asset in household portfolio choice and portfolio efficiency under uncertainty. This is particularly important for transition economies like China, where housing asset is the absolute important asset in household's balance sheet.

Household income and wealth in China has sustainably increased since the housing reform in 1998. According to the National Statistics Bureau of China, household income per capita increased from 343 RMB to 33,616 RMB from 1978 to 2016. The average household wealth per capita in China reached 169,077 RMB in 2016, among which housing wealth has become the largest asset in the balance sheets of urban households in China. The share of the net value of housing assets in total net wealth rose from 44% in 2002 to 73.4% in 2010. From 2000 to 2012, households' average housing wealth increased from RMB123,700 to RMB510,900, with an annual growth rate of more than 14.07%.

During the last decades of the 20th century, China has also experienced series of deep marketization reforms, which leads directly to the increasing uncertainty of income, as well as unexpected "human capital expenditures" under an incomplete social security system. On the one hand, the economic reform abolished the traditional employment distribution pattern and increased the

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competitiveness of the labor market. Risk of unemployment is increasing as well as the future earnings and income of household. On the other hand, households are facing with uncertainty of their future expenditure as the consequences of social and economic reform as well as the imperfection social security system in China. Take healthcare and education as an example. Education and medical expenditures account for such a substantial part of consumer spending that unexpected price changes could significantly affect the consumption of urban households. In addition, lack of social security system, public supervision and fiscal subsidies further increases multitude uncertainties of future expenditure associated with educational and medical care. In the field of education, the education burden has been shifted from state finances to families and individuals since the reform of Chinese education cost system in 1997. However, without strict regulatory system, there are problems such as blind expansion of education institutions and chaotic charging standards, which make it difficult for consumers to estimate their educational expenditure accurately. Meanwhile, due to the professional monopoly of medical service and the imperfect market management, people often face arbitrary charges, false prices, and registration difficulties. And as the Chinese medical security system is not consummated, many expensive drugs and treatments cannot enjoy medical insurance reimbursement. The resulting medical risks can only be borne by residents themselves.

Paralleled with the high income and expenditure uncertainty, there are several concerns on household investment behavior in urban China. The first issue is high saving rate raised by precautionary motives, which simultaneously decreases household consumption and total investment. More importantly, housing assets account for an excessive proportion in the asset allocation of China's household. Due to the poor liquidity of housing, a high proportion of housing assets will reduce the need for financial market participation and financial asset, which will bring sustainable challenges to financial market development.

In this study, we investigate the role of housing in household's portfolio under uncertainty. Housing asset is included as an important share of households' non-financial asset. We first investigate the hedging role of housing and other financial assets (such as deposit and stocks) under income and expenditure uncertainty. Second, from a structural perspective, we explore household's asset allocation under uncertainty. Further, we analyze the role of housing asset in impacting household portfolio efficiency under uncertainty for households who allocate their portfolio on risky asset. With the comprehensive database, we find that uncertainty of future expenditure is important in household asset choices and housing plays a significant role in hedging such uncertainty. When face higher income uncertainty, household will decrease the share of housing asset in total asset by increasing safe financial asset (deposit); when face higher expenditure uncertainty, household will increase decrease the share of housing asset in total asset by purchasing new houses or increasing housing equity (such as moving into bigger houses) and decreasing risky financial investment (such as stock). Finally, due to the interaction between housing asset and financial assets allocation under uncertainty, including housing as a hedging asset will reduce the stock market participation and thus decreases the portfolio effectiveness of risky assets. We then provide policy recommendations on social insurance and financial system for the government.

This study contributes to the previous literature from three key aspects. First, in addition to the well-discussed income uncertainty associated with unemployment and competitive wages, we also offer a new perspective of uncertainty, the expenditure uncertainty associated with future undetermined expenditure in education and medical care. The latter is with especially practical importance in transition economies with imperfect social security system. Second, we extend previous studies of portfolio choice by explicitly considering the role of housing in household's asset allocation, and empirically test the hedging channel with heterogeneous assets under different types of uncertainty. Third, our research could fill the gaps in the research on household portfolio effectiveness considering the interaction of housing asset and financial asset allocation under uncertainty, which could provide investment advice for the asset allocation of residents under emerging financial environment.

The rest of paper is organized as follows. The next section provides data description and the establish process of key variables in this paper. Section 3 presents empirical strategies. Section 4 discusses the empirical results and provides robustness checks. Section 5 concludes.

Data and Key Variables

Our empirical database comes from China Household Finance Survey (CHFS) in 2013 and 2015, which is massive micro-level survey conducted by the Survey and Research Center for China Household Finance, Southwestern University of Finance and Economics (SWUFE). The CHFS 2013 includes 28,228 households covering 29 provinces (four direct-controlled municipalities included), 262 counties, and 1,048 communities, offering a comprehensive and detailed reflection of the condition of

Chinese households' finances and financial literacy indicators. The CHFS 2015 is conducted by the Survey and Research Center for China Household Finance at the Southwestern University of Finance and Economics (SWUFE), and Chinese Family Database (CFD) of Zhejiang University, and China Household Employment Survey (CHES) conducted by the Survey Data Center of Jinan University, China. The CHFS 2015 includes 40,000 households covering 29 provinces (four direct-controlled municipalities included), 363 counties, and 1,439 communities. The questionnaire of CHFS 2015 is similar to CHFS 2013, with which we could also extract a two-year panel of repeated households. More detailed introduction of the database could be found in Gan et al. (2013). We sort CHFS 2013 and 2015 to form panel data, retaining households with two-year survey data. On the basis of this, households with household heads less than 18 years of age, households with household income below 100 yuan, and households with household assets below 500 yuan are dropped. The total sample size is 24,490.

Key variables in this paper include, household's asset, uncertainty (namely, income uncertainty and expenditure uncertainty) and household's portfolio effectiveness.

Assets

Family assets include financial assets and non-financial assets. According to the statistics of residents' family assets in CHFS, non-financial assets are divided into housing assets, industrial and commercial assets, automobile assets and other non-financial assets; financial assets are divided into cash, demand deposits, time deposits, stocks, bonds, funds, financial derivatives, financial products, non-RMB financial assets, gold and loans. For the choice of Chinese families' precautionary saving, this paper chooses two kinds of safe assets, housing and fixed deposit, to conduct research. For the allocation of risky assets, the stocks, bonds, funds, and gold assets with higher participation rates in Chinese households are selected.

Risk assets refer to assets in the asset structure of commercial banks and non-bank financial institutions that have uncertain future yields and may incur losses, such as stocks, bonds, funds, financial derivatives, financial products, non-RMB financial assets, gold and loans. A safe asset is an asset that has a certain rate of return and no default risk, such as cash, demand deposits, time deposits. For the risk of housing assets, McCarthy (2004) classifies housing assets as risk assets. However, in the Chinese housing market, housing assets are long-term investments with relatively stable positive returns. R. Cooper and G. Zhu (2013) considered that the income from housing assets mainly consists of two parts: rising prices and potential rental returns. Evidence shows that rent return is a major component of housing asset income, while the contribution of long-term housing price increases is low. As housing rents are relatively stable, housing assets reflect residents' risks and returns similar to bonds. This study is based on the characteristics of the Chinese market and draws lessons from R. Cooper and G. Zhu (2013) that the housing assets in the Chinese market are classified as safe assets.

Uncertainty

Income Uncertainty: Referring to Dynan's (2004) research method, because of the stable relationship between personal characteristics and human capital factors of family members and family permanent income, income can be estimated by constructing the family income equation. The annual actual income of urban households is used as the dependent variable, and because the family's asset selection will affect the uncertainty of the assets' earnings income, property income is excluded from the calculation of household actual income in order to prevent endogenous problems. Referring to the impact of various human capital factors on income in the Mincer income equation, we choose the age of the householder, the square of the age, gender, presence or absence of work, education level, proportion of the employed population, and the total number of jobs as the independent variables of household income equation. The predicted values and residuals of the equations respectively represent the family's permanent income and uncertain income. Further, because of the different household income levels, the absolute amount of income fluctuations will have a different degree of influence on families, which makes the income fluctuations of different years and families less comparable (Luo Chuliang, 2006). Therefore, the equation residuals are standardized using household income in the measurement of uncertainty. The calculation formula of income uncertainty is shown as follows. We first calculate the residual of Mincer wage equation:

$$lnincome_i = C + X_i * \beta + resid_i$$

where X_i denotes household characteristics include the age, age-square, gender, educational background and occupation of household head, time and regional fixed effect. $resid_i$ represents residual of the regression. Thus, the residual of the empirical model can present the deviation degree

of individual income from the average real income under the same condition, which can be regarded as the absolute deviation of earning income uncertainty. Thus, the ratio of absolute value of the residual to disposable income can denote a relative deviation of earning income uncertainty. In the second step, we establish a new variable unc_i as a measurement of income uncertainty

$$incunc_i = \frac{|resid_i|}{lnincome_i}$$

Expenditure Uncertainty: Expenditure uncertainty is defined as the uncertainty in household's human capital investment, which includes expenditure on education and medical care. Based on the empirical research conclusions of Mocan et al. (2004) and Feng Jin (2006), this paper considers that the main factors affecting residents' medical expenditure are the age, health status, income status, and medical security of residents. Referring to Xu Anqi (2004) and Li Wenli (2005), the main factors affecting household education expenditures in China are the level of householder education, family education level, family income and family location. Similar to the calculation of the income uncertainty, the actual medical and education expenditure of households is used as the dependent variable ($lnhcexpenditure_i$). Establish a regression equation using the age of the head of the household, the square of the age, the family population, the per capita dependency ratio, the number of people with medical insurance and the number of students, then characterize the uncertainty of human capital investment using residual items standardized after medical education expenditure. Similarly, we have

$$lnhcexpenditure_i = C + X_i * \beta + expresid_i$$

$expresid_i$ represents residual of the regression. In the second step, we establish a new variable unc_i as a measurement of income uncertainty

$$expunc_i = \frac{|expresid_i|}{lnhcexpenditure_i}$$

Portfolio Effectiveness

Sharpe ratio was used for the household assets allocation efficiency index. It uses the long-term average excess return of the asset portfolio to reflect the yield of the portfolio, and uses the standard deviation of the yield over a period of time to characterize the risk. The formula is:

$$Sharpe\ Ratio_p = \frac{E(R_P) - R_f}{\sigma_P}$$

Numerator represents the long-term average excess return of the asset portfolio, and denominator represents the standard deviation of the portfolio yield. A positive Sharpe ratio means that the yield is above the volatility risk; if it is negative, it means that the risk is higher than the rate of return. As a result, Sharpe ratio can be calculated for each portfolio, that is, the ratio of return on investment to risk. The higher the ratio, the more efficient the portfolio.

In this study, we choose stocks, bonds, funds, and gold for the Sharpe ratio of household assets. Due to CHFS data limitations, the market value of a specific subcategory of an asset configured by a home cannot be accurately counted, but can only be accurate to a large asset class. We adopt Pelizzon and Weber (2009) and Wu Weixing et al.'s (2015) method of replacing the average index in the calculation of asset validity, and averages the same category of assets to obtain the overall Sharpe ratio for each category of asset. Using the Shanghai Stock Exchange Index and Shenzhen Stock Index monthly earnings in accordance with the turnover of weighted yields represents stock returns, using the Shanghai Stock Exchange Fund Index and the Shenzhen Stock Exchange Fund Index in accordance with the turnover of the weighted monthly yield represents fund returns, using the monthly yield of the bond index represents the bond yield; using the monthly average rate of return calculated by the spot price of gold represents the earnings of holding gold.

Regarding the choice of time interval, Wu Weixing et al. (2015) believes that the Chinese economy has shown obvious periodicity during the decade from 2003 to 2013, and the financial market represented by the stock market has also undergone a complete cycle. Therefore, the interval for calculating the profitability sequence in this paper is from February 2003 to December 2015. After obtaining the sequence of yields of various assets, we calculate the excess returns and volatility of various assets based on the series of returns, and further calculate the Sharpe ratio of each household considering the weight of each household's assets (A_p/A).

$$sharperatio = \sum_p \frac{A_p}{A} \frac{E(R_P) - R_f}{\sigma_P}$$

Table 1 the Sharpe ratio for stock, bond, fund and gold

asset	Stock	bond	fund	gold
Sharpe ratio	0.0845	0.1379	0.1592	0.1290

Table 1 shows the Sharpe ratio for the four risk assets. It can be found that the Sharp ratio of stocks in China's financial market is the lowest, while the ratio of fund is the highest.

Other control variables include: household financial status (household income, total assets and household consumption rate), household's demographic characteristics (number of children in the family, number of elderly people in the family, and the size of the family), demographic characteristics of the household's head (age and age squared[4], educational level, gender and occupation). Modern asset portfolio theory believes that risk will not affect the choice of household asset portfolio, but empirical research (Flavin and Yamashita, 2002; Yin Zhichao et al., 2015) shows that risk attitude has a significant impact on the choice of household assets. Based on the CHFS about the willingness to invest in different venture investment projects, we further control the household risk attitude by setting 1 to 5 dummy variables. Meanwhile, considering the important role of financial literacy on households' balance sheet and portfolio choices (Van Rooji et al., 2012; McArdle et al., 2009), we include the proxy for financial literacy according to the degree of attention the household head usually takes to economic and financial information acquired in CHFS. We also control regional fixed effects according to household's residence in the eastern, central and western regions. The descriptive statistics of variable is shown in Table 2.

Table 2 Descriptive statistics of variable

Variable	Descriptions	Mean	Std. dev.
incunc	Income uncertainty indicator	0.0921	0.1086
expunc	Expenditure uncertainty indicator	0.1597	0.2449
housingratio	Housing assets as a percentage of total assets	0.6927	0.3259
depositratio	Deposit assets as a percentage of total assets	0.0365	0.1117
stockratio	Stock assets as a percentage of total assets	0.0074	0.0428
sharperatio	Household portfolio efficiency indicator	0.0066	0.0211
income_total	Household's total income, including wage, asset returns, transfer and unregulated income (yuan)	67942.23	666800.7
asset	Household's total asset (yuan)	1285384	9957218
income	Household's total income, including wage, transfer and unregulated income (yuan)	59307.93	651919
age	Age of household head	50.4246	14.5343
gender	Gender of household head	0.7175	0.4502
edu	The education level of household head	3.8474	1.7273
risk	The risk attitude of household head	1.9724	1.1770
riskaverse		0.6577	0.4745
risklike		0.1024	0.3032
literacy	Financial attention of household head	2.2471	1.0938
num	Household population	3.6795	1.5738
consumratio	Household consumption rate	6.7265	32.2715
east	Household location	0.6329	0.4820
west	Household location	0.2304	0.4211

Table 3 exhibits the comparable statistics of Sharpe Ratio among different cohorts. The families are grouped according to the level of characteristics from low to high. The risk attitudes 1, 2 and 3 respectively indicate risk aversion, risk neutrality and risk appetite; the regional groupings 1, 2 and 3 indicate eastern, central and western regions; gender and employment is 0 indicates the head of the household is women and unemployed. Income, assets, education and the risk appetite have a positive correlation with the participation of risk market and the Sharpe ratio. Families of eastern region, female

[4] The household age has a non-linear feature on household asset allocation. Flavin and Yamashita (2002) and Shum (2006) believed that age and stock market participation are inverse U-shaped correlated. Therefore, we use age and age squared to control the age and describe the structural changes of assets in the life cycle.

and employed have higher participation rates and Sharpe ratio. There is not much difference between the household head age groups.

Table 3 Comparable statistics of Sharpe Ratio (different cohorts)

	rank	Sharpe Ratio	participants (%)		rank	Sharpe Ratio	participants (%)
income	1	0.0034	7.23%	risk attitude	1	0.0044	9.96%
	2	0.0046	9.52%		2	0.0099	22.82%
	3	0.0062	13.26%		3	0.0158	33.76%
	4	0.0120	28.60%	literacy	1	0.0030	7.01%
asset	1	0.0019	3.73%		2	0.0096	22.48%
	2	0.0037	7.79%		3	0.0172	35.46%
	3	0.0069	15.46%	age	1	0.0074	17.96%
	4	0.0137	31.70%		2	0.0067	15.16%
edu	1	0.0029	6.34%		3	0.0066	14.44%
	2	0.0092	21.29%		4	0.0056	11.26%
	3	0.0154	33.18%	gender	0	0.0077	16.15%
region	1	0.0074	16.75%		1	0.0061	14.09%
	2	0.0049	10.78%	employment	0	0.0064	13.30%
	3	0.0051	11.26%		1	0.0067	15.67%

Empirical Design

Our empirical process includes three steps. In the first step, we investigate the role of income and expenditure uncertainty on household hedging asset choices. Fixed effect Probit model is used to estimate the binary choice with our extract panel data.

$$Prob(D\_purchase_{i,t} = 1) = \Phi\left(\alpha_1 + \beta_1 \mathrm{inc}unc_{i,t} + \beta_2 expunc_{i,t} + \zeta_k Y_{i,t} + \varepsilon_{i,t}\right)$$

where $D\_purchase_{i,t}$ denotes whether household purchase a new house in the survey year. $Y_{i,t}$includes household financial status (household income, total assets and household consumption rate), household's demographic characteristics (number of children in the family, number of elderly people in the family, and the size of the family), demographic characteristics of the household's head (age and age squared[5], educational level, gender and occupation), household's risk attitude and financial literacy, as well as the regional fixed effects. Φ is the cumulative distribution function of the standard normal distribution. We also test the choice probability of other assets,

$$Prob(D\_deposit_{i,t} = 1) = \Phi\left(\alpha_2 + \beta_3 incunc_{i,t} + \beta_4 expunc_{i,t} + \zeta_k Y_{i,t} + \varepsilon_{i,t}\right)$$

$$Prob(D\_stock_{i,t} = 1) = \Phi\left(\alpha_3 + \beta_5 incunc_{i,t} + \beta_6 expunc_{i,t} + \zeta_k Y_{i,t} + \varepsilon_{i,t}\right)$$

where $D\_deposit_{i,t}$ and $D\_stock_{i,t}$ denotes whether household makes a deposit or invest a stock in the survey year respectively.

In the second step, we test the impact of uncertainty on household's asset allocation structure. We focus on the ratio of housing asset to household total asset. Tobit model is used to provide estimation with the left censor characteristics of the dependent indicator. The corresponding empirical model is,

$$housingratio^* = \alpha_4 + \beta_7 incunc_{i,t} + \beta_8 expunc_{i,t} + \zeta_k Y_{i,t} + \varepsilon_{i,t}$$

$$housingratio = housingratio^* \quad if \quad housingratio^* > 0$$

$$housingratio = 0 \quad otherwise$$

In the third step, we examine the impact of uncertainty on household portfolio efficiency for the households who allocate their portfolio on risky asset. Heckman two-stage process is employed to eliminate the sample selection bias. Specifically, in the first stage, we estimate the probability of owning risky asset. In the second stage, we control the inverse Mills ratio in the regression of uncertainty on the compounding sharp ratio. The empirical model is,

$$Prob\left(D\_risky_{i,t} = 1 \middle| W_{i,t}\right) = \Phi({W_{i,t}}^T \gamma)$$

$$lambda_i = \frac{\phi({W_{i,t}}^T \gamma)}{\Phi({W_{i,t}}^T \gamma)}$$

$$sharperatio_{i,t} = \alpha_5 + \beta_9 incunc_{i,t} + \beta_{10} expunc_{i,t} + \beta_{11} incunc_{i,t} \times own_{i,t} + \beta_{12} expunc_{i,t} \times own_{i,t} + \beta_{13} own_{i,t} + lambda_{i,t} + \zeta_k Y_{i,t} + \varepsilon_{i,t}$$

where W_i is a vector of explanatory variables impacting a household's risky asset ownership, which includes household income uncertainty, age, gender, risk appetite, financial literacy, family size, education, family assets and income, consumption rate as well as regional fixed effects; ${W_i}^T$ is the transpose of the matrix W_i and γ is a vector of parameters, as defined before. ϕ is the density of the distribution function of the standard normal distribution, while Φ is the cumulative distribution function of the standard normal distribution.

We also provide robustness checks with alternative measures of uncertainty.

[5] The household age has a non-linear feature on household asset allocation. Flavin and Yamashita (2002) and Shum (2006) believed that age and stock market participation are inverse U-shaped correlated. Therefore, we use age and age squared to control the age and describe the structural changes of assets in the life cycle.

Empirical results

Uncertainty and the Hedging role of Housing Asset

The results in column (1) show that, the impact of expenditure uncertainty on the choice of newly purchased housing assets is significantly positive at the 5% level of significance. Column (2) show that, income uncertainty increases the probability of households holding fixed-term deposits, while expenditure uncertainty reduces the probability of households holding fixed-term deposits at the 1% level of significance. Column (3) show that at the 1% level of significance, expenditure uncertainty will reduce the probability of family equity market participation. Housing assets and fixed deposits are important options for Chinese families to make preventive savings. Families tend to choose to hold fixed-term deposits to defense income uncertainty, and in the face of expenditure uncertainty they tend to buy new house assets.

Table 4 Uncertainty and household's choice of hedging assets

	(1) D_purchase	(2) D_deposit	(3) D_stock
incunc	-0.0068	1.3013***	0.3551
	(0.0391)	(0.2003)	(0.3620)
expunc	0.0199**	-0.1806**	-0.4972***
	(0.0099)	(0.0837)	(0.1668)
age	-0.0057***	0.0282***	0.1157***
	(0.0012)	(0.0007)	(0.0137)
agesq	0.0001***	-0.0001	-0.0011***
	(0.0001)	(0.0001)	(0.0001)
gender	-0.0089	0.0135	-0.1730***
	(0.0061)	(0.0352)	(0.0633)
riskaverse	0.0094	0.1386***	-0.4110***
	(0.0069)	(0.0373)	(0.0622)
risklike	0.0034	-0.2600***	0.5438***
	(0.0103)	(0.0577)	(0.0781)
literacy	-0.0049*	0.0619***	0.4470***
	(0.0028)	(0.0148)	(0.0281)
edu	-0.0165***	0.0635***	0.2135***
	(0.0019)	(0.0108)	(0.0206)
num	-0.0187***	-0.0923***	-0.1052***
	(0.0021)	(0.0117)	(0.0221)
east	-0.0176**	0.1578***	0.0925
	(0.0084)	(0.0510)	(0.0923)
west	0.0112	-0.1376**	-0.1745
	(0.0098)	(0.0589)	(0.1072)
lnasset	0.0544***	0.2534***	0.3524***
	(0.0019)	(0.0101)	(0.0210)
lnincome	-0.0042	0.1963***	0.2481***
	(0.0027)	(0.0142)	(0.0243)
consumratio	-0.0000	-0.0012	0.0015
	(0.0001)	(0.0009)	(0.0013)
obs	11224	17165	17165
LR chi2	749.69	54.36	748.88
Prob>chi2	0.0000	0.0000	0.0000

Notes:
1. The dependent variable in column (1) is *D_purchase* (whether to purchase a new house in 2013-2015). The dependent variable in column (2) is *D_deposit* (whether to make a deposit in 2013-2015). The dependent variable in column (3) is *D_stock* (whether to invest in stock in the 2013-2015). Probit model is adopted to estimate the impact of uncertainty on household's hedging asset choice.
2. Robust standard errors are reported in parentheses: *** denotes p <0.01, ** denotes p<0.05, and *denotes p<0.1.
3. ln denotes logarithm of the variable.

Uncertainty and Household Asset Allocation

The results in column (1) show that income uncertainty reduces the proportion of household housing assets at a significance level of 1%, and expenditure uncertainty increases the proportion of household housing assets at a significant level of 10%. In addition, the results in (2)(3) show that income uncertainty increases the proportion of time deposits at a 1% level of significance, and the uncertainty of expenditure reduces the proportion of equity assets at a 1% level of significance.

Table 5 Uncertainty, housing purchase and household's asset allocation

	(1) housingratio	(2) depositratio	(3) stockratio
incunc	-0.0928***	0.1578***	0.0131
	(0.0340)	(0.0382)	(0.0299)
expunc	0.0195*	-0.0263	-0.0504***
	(0.0109)	(0.0159)	(0.0147)
age	0.0111***	0.0036***	0.0094***
	(0.0013)	(0.0014)	(0.0011)
agesq	-0.0001***	-0.0000	-0.0001***
	(0.0000)	(0.0000)	(0.0000)
gender	0.0142**	-0.0011	-0.0145***
	(0.0067)	(0.0069)	(0.0054)
riskaverse	0.0102	0.0346***	-0.0395***
	(0.0065)	(0.0074)	(0.0053)
risklike	-0.0437***	-0.0442***	0.0454***
	(0.0101)	(0.0115)	(0.0064)
literacy	-0.0221***	0.0127***	0.0373***
	(0.0027)	(0.0029)	(0.0022)
edu	-0.0107***	-0.0161***	-0.0093**
	(0.0021)	(0.0023)	(0.0019)
num	-0.0055***	0.0093***	0.0173***
	(0.0021)	(0.0021)	(0.0017)
east	0.0145	0.0264***	0.0045
	(0.0095)	(0.0101)	(0.0078)
west	0.0075	-0.0257**	-0.0180**
	(0.0108)	(0.0117)	(0.0091)
lnasset	0.0534***	0.0359***	0.0238***
	(0.0015)	(0.0019)	(0.0016)
lnincome	0.0140***	0.0237***	0.0172***
	(0.0024)	(0.0027)	(0.0020)
consumratio	0.0003*	-0.0003*	0.0001
	(0.0001)	(0.0002)	(0.0001)
constant	0.4335***	-1.0340***	-0.8040***
	(0.0487)	(0.0549)	(0.0450)
obs	17165	17165	17165
LR chi2	1614.88	912.54	1156.73
Prob>chi2	0.0000	0.0000	0.0000

Notes:
1. The dependent variable in column (1) is *housingratio* (the ratio of housing asset to household's total asset). The dependent variable in columns (2) and (3) is *depositratio* (the ratio of deposits to household's total asset) and *stockratio* (the ratio of stocks to household's total asset). Tobit model is adopted to estimate the impact of uncertainty on household's asset allocation.
2. Robust standard errors are reported in parentheses: *** denotes p <0.01, ** denotes p<0.05, and *denotes p<0.1.
3. ln denotes logarithm of the variable.

Portfolio Effectiveness

From the participation of the decision-making equation, the results in column (2) show that the income uncertainty will increase the market participation rate of risk assets under the 5% significance

level. Expenditure uncertainty will reduce the risk asset market participation at the 1% level of significance.

The Sharpe ratio regression results are basically consistent with the results of participation in the decision equations. Column (1) show that the impact of income uncertainty on the household Sharpe ratio is significantly positive, and that the expenditure uncertainty is significant negative. Savings from income uncertainty do not reduce household participation in other assets. Households facing uncertainty in income can better configure their assets and adjust the asset structure to increase portfolio efficiency. The newly purchased housing with unclear expenditures squeezes out risk assets, which reduces the efficiency of household asset portfolios. In addition, the results in column (1) show that holding houses also makes the household portfolio less effective.

Add the intersection of uncertainty and holding houses in the model. Column (3) show that holding houses weakens the positive effect of income uncertainty on the Sharpe ratio at the 1% level of significance, and increases the negative effect of expenditure uncertainty at the 10% level of significance. The holding of real estate will reduce portfolio efficiency when families face the same uncertainty.

Table 6 Uncertainty and household's portfolio effectiveness

	(1) sharperatio	(2) D_stock	(3) sharperatio	(4) D_stock
incunc	0.0120***	0.5933**	0.0316***	1.4865**
	(0.0021)	(0.2837)	(0.0040)	(0.6240)
expunc	-0.0076***	-0.3186***	-0.0045**	-0.1041
	(0.0008)	(0.1244)	(0.0020)	(0.2922)
own	-0.0152***	-0.6373***	-0.0127***	-0.5104***
	(0.0010)	(0.0788)	(0.0010)	(0.1075)
incunc×own			-0.0225***	-1.0245
			(0.0040)	(0.6438)
expunc×own			-0.0040*	-0.2638
			(0.0022)	(0.3206)
age	0.0023***	0.0903***	0.0023***	0.0905***
	(0.0001)	(0.0101)	(0.0001)	(0.0101)
agesq	-0.0000***	-0.0008***	-0.0000***	-0.0008***
	(0.0000)	(0.0001)	(0.0000)	(0.0001)
gender	-0.0056***	-0.1922***	-0.0056***	-0.1915***
	(0.0005)	(0.0495)	(0.0004)	(0.0495)
riskaverse	-0.0093***	-0.3486***	-0.0093***	-0.3476***
	(0.0007)	(0.0542)	(0.0006)	(0.0492)
risklike	0.0080***	0.2685***	0.0080***	0.2692***
	(0.0007)	(0.0656)	(0.0007)	(0.0656)
literacy	0.0094***	0.3696***	0.0094***	0.3697***
	(0.0005)	(0.0214)	(0.0005)	(0.0214)
num	-0.0019***	-0.0803***	-0.0018***	-0.0798***
	(0.0002)	(0.0168)	(0.0002)	(0.0168)
edu	0.0053***	0.2026***	0.0052***	0.2021***
	(0.0003)	(0.0159)	(0.0003)	(0.0159)
east	0.0026***	0.1085	0.0026***	0.1078
	(0.0005)	(0.0716)	(0.0005)	(0.0716)
west	-0.0022***	-0.0883	-0.0022***	-0.0891
	(0.0006)	(0.0823)	(0.0006)	(0.0823)
lnasset	0.0095***	0.3996***	0.0095***	0.4003***
	(0.0006)	(0.0177)	(0.0006)	(0.0177)
lnincome	0.0054***	0.2337***	0.0054***	0.2350***
	(0.0003)	(0.0192)	(0.0003)	(0.0192)
consumratio	0.0001***	0.0014	0.0001***	0.0015
	(0.0000)	(0.0010)	(0.0000)	(0.0010)
constant	-0.2331***	-9.7642***	-0.2354***	-9.8993***
	(0.0149)	(0.4479)	(0.0151)	(0.4559)
Inverse Mils Ratio	0.0225***		0.0224***	
	(0.0016)		(0.0016)	
obs	17165	17165	17176	17176

LR chi2	2107.12	1106.90	2107.49	1108.63
Prob>chi2	0.0000	0.0000	0.0000	0.0000

Notes:
1. The dependent variable in columns (1) and (3) is *sharperatio* (weighted Sharpe ratio of household's risky assets). Tobit model is adopted to estimate the impact of uncertainty on household's portfolio effectiveness. The dependent variable in columns (2) and (4) is *D_stock* (whether to invest in a new stock in 2013-2015). Probit model is adopted to estimate the impact of uncertainty on household's housing purchase behavior.
2. Robust standard errors are reported in parentheses: *** denotes p <0.01, ** denotes p<0.05, and *denotes p<0.1.
3. ln denotes logarithm of the variable.

Robustness Check

We further provide robustness checks on the alternative measures of income uncertainty and expenditure uncertainty.

Alternative Measures of Uncertainty I

Risk of unemployment is a widely used measurement of income uncertainty, especially in developing economies (Zhou, 2011). As an alternative proxy for income uncertainty, we estimated the probability of unemployment of the household's head (*incunc2*) in the survey year with Probit model. Meanwhile, based on the discussion above on the Chinese educational and medical insurance system, we identify groups who may potentially face a high level of expenditure income uncertainty and estimate the role of housing in their household consumption, namely the households with child at primary or junior school, and the households with older people face most unexpected expenditure on future education or medical care. As an alternative proxy for expenditure uncertainty, we establish variable *expunc2* which denotes the "dependent ratio" (the ratio of household's members whose age is less than 12 or exceeds 60). The regression results are shown in Table 7. We find that relative to income uncertainty, expenditure uncertainty is significant in increasing households' housing purchase probabilities. The role of income and expenditure uncertainty on household's asset allocation is also consistent with our former findings.

Table 7 Uncertainty, housing purchase and household's asset allocation (robust check I)

	(1) D_purchase	(2) D_purchase	(3) housingraitio
incunc2	-0.0122		-0.1901**
	(0.0085)		(0.0089)
expunc2		0.0188**	0.0729***
		(0.0085)	(0.0091)
age	-0.0052***	-0.0049***	0.0126***
	(0.0010)	(0.0010)	(0.0011)
agesq	0.0000***	0.0000***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)
gender	-0.0097*	-0.0093*	-0.0053
	(0.0054)	(0.0053)	(0.0060)
riskaverse	0.0060	0.0057	0.0114**
	(0.0058)	(0.0058)	(0.0053)
risklike	0.0009	0.0011	-0.0464***
	(0.0086)	(0.0086)	(0.0081)
literacy	-0.0072***	-0.0074***	-0.0219***
	(0.0024)	(0.0024)	(0.0022)
num	-0.0163***	-0.0156***	-0.0051***
	(0.0017)	(0.0018)	(0.0018)
east	-0.0142**	-0.0147**	0.0255***
	(0.0069)	(0.0069)	(0.0079)
west	0.0158**	0.0155*	0.0186**
	(0.0081)	(0.0081)	(0.0090)
lnasset	0.0491***	0.0494***	0.0425***

	(0.0016)	(0.0016)	(0.0013)
lnincome	-0.0018	-0.0015	0.0132***
	(0.0019)	(0.0019)	(0.0017)
consumratio	-0.0000	-0.0001	-0.0001
	(0.0001)	(0.0001)	(0.0001)
constant			-0.3980***
			(0.0392)
obs	15857	15857	24426
LR chi2	1248.97	1251.73	1753.99
Prob>chi2	0.0000	0.0000	0.0000
R2	0.1144	0.1146	

Notes:
1. The dependent variable in columns (1) and (2) is *D_purchase* (whether to purchase a new house in 2013-2015). Probit model is adopted to estimate the impact of uncertainty on household's housing purchase behavior. The dependent variable in column (3) is *housingratio* (the ratio of housing asset to household's total asset). Tobit model is adopted to estimate the impact of uncertainty on household's asset allocation.
2. Robust standard errors are reported in parentheses: *** denotes p <0.01, ** denotes p<0.05, and *denotes p<0.1.
3. ln denotes logarithm of the variable.

Alternative Measures of Uncertainty II

The medical insurance plan is designed as a current premium paid for a future reduced price of health care. It is straightforward that the acquirement of medical insurance will reduce the sensitivity of household's facing expenditure uncertainty associated with medical care (Philipson and Zanjani, 2014). We then establish a new proxy for expenditure uncertainty (*expunc3*) which denotes the ratio of household's members whose age is less than 12 or who does not currently have a medical insurance plan. The results exhibited in Table 8 are support the robustness of our findings.

Table 8 Uncertainty and household's portfolio effectiveness (robust check)

	(1) sharperatio	(2) D_stock	(3) sharperatio	(4) D_stock
incunc2	0.0067***	0.2789***	0.0094***	0.3951**
	(0.0006)	(0.0714)	(0.0013)	(0.1865)
expunc3	-0.0046***	-0.1839***	0.0018***	-0.1124
	(0.0004)	(0.0575)	(0.0009)	(0.1400)
own	-0.0149***	-0.6206***	-0.0098***	-0.3992***
	(0.0008)	(0.0666)	(0.0011)	(0.1502)
incunc2×own			-0.0031***	-0.1269**
			(0.0013)	(0.1912)
expunc3×own			-0.0073**	-0.3414
			(0.0011)	(0.1480)
age	0.0022***	0.8460***	0.0022***	0.0841***
	(0.0001)	(0.0087)	(0.0001)	(0.0088)
agesq	-0.0000***	-0.0008***	-0.0000***	-0.0008***
	(0.0000)	(0.0001)	(0.0000)	(0.0001)
gender	-0.0061***	-0.2146***	-0.0061***	-0.2152***
	(0.0004)	(0.0432)	(0.0004)	(0.0433)
riskaverse	-0.0079***	-0.3059***	-0.0079***	-0.3059***
	(0.0005)	(0.0412)	(0.0005)	(0.0413)
risklike	0.0085***	0.2834***	0.0084***	0.2818***
	(0.0005)	(0.0544)	(0.0005)	(0.0544)
literacy	0.0091***	0.3551***	0.0090***	0.3547***
	(0.0004)	(0.0177)	(0.0004)	(0.0178)
num	-0.0018***	-0.0745***	-0.0018***	-0.0739***
	(0.0001)	(0.0150)	(0.0001)	(0.0150)
east	0.0079***	0.2193***	0.0053***	0.2174***
	(0.0005)	(0.0622)	(0.0005)	(0.0623)

west	-0.0001	-0.0001	0.0001	-0.0003
	(0.0713)	(0.0713)	(0.0005)	(0.0714)
lnasset	0.0093***	0.3918***	0.0093***	0.3964***
	(0.0005)	(0.0148)	(0.0005)	(0.0150)
lnincome	0.0042***	0.1779***	0.0041***	0.1765***
	(0.0002)	(0.0148)	(0.0002)	(0.0149)
consumratio	0.0000***	0.0005	0.0000***	0.0005
	(0.0000)	(0.0005)	(0.0000)	(0.0005)
constant	-0.2251***	-9.3327***	-0.2281***	-9.5623***
	(0.0117)	(0.3599)	(0.0119)	(0.3832)
Inverse Mils Ratio	0.0227***		0.0224***	
	(0.0013)		(0.0013)	
obs	24246	24246	24246	24246
LR chi2	3015.38	1688.44	2107.49	1683.89
Prob>chi2	0.0000	0.0000	0.0000	0.0000

Notes:
1. The dependent variable in columns (1) and (3) is *sharperatio* (weighted Sharpe ratio of household's risky assets). Tobit model is adopted to estimate the impact of uncertainty on household's portfolio effectiveness. The dependent variable in columns (2) and (4) is *D_stock* (whether to invest in a new stock in 2013-2015). Probit model is adopted to estimate the impact of uncertainty on household's housing purchase behavior.
2. Robust standard errors are reported in parentheses: *** denotes p <0.01, ** denotes p<0.05, and *denotes p<0.1.
3. ln denotes logarithm of the variable.

Conclusion

Based on China Household Finance Survey in 2013 and 2015, this paper empirically investigates the hedging role of housing asset under income and expenditure uncertainty in transition economy like China. Household's asset allocation options and corresponding portfolio efficiency under such uncertainty are studied.

We find that, the hedging role of housing and other financial assets (such as deposit and stocks) under income and expenditure uncertainty is significantly different. The increment of uncertainty of future expenditure will increase household's provability to purchase a house as a hedging device. From a structural perspective, household will adjust their asset allocation under uncertainty dynamically: When face higher income uncertainty, household will decrease the share of housing asset in total asset by increasing safe financial asset (deposit); when face higher expenditure uncertainty, household will increase decrease the share of housing asset in total asset by purchasing new houses or increasing housing equity (such as moving into bigger houses) and decreasing risky financial investment (such as stock). Since housing asset interacts with financial assets, the demand for housing under uncertainty will impact household portfolio efficiency under uncertainty for households who allocate their portfolio on risky asset: including housing as a hedging asset will reduce the stock market participation and thus decreases the portfolio effectiveness of risky assets.

Regarding the hedging role of housing and its impact on household financial asset holding and portfolio effectiveness, the Chinese central and local governments should further expand fiscal budget on education and health care to alleviate the pressure of the household expenditure. Meanwhile, it is necessary to minimize the negative effect of income uncertainty by improving unemployment insurance and social security system. These policies will be not only the essential components of policy package to cool the excessive demand for housing in the Chinese housing market, but also have critical implication in household's financial well-being and the sustainability of financial market development.

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Impact of Money Supply on China Housing Prices under the Expansion of Fictitious Economy ——An Empirical Analysis Based on VAR Model

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With the development of world economy and the continuous improvement of financial innovation, the rapid integration of the real economy and fictitious economy has drawn the attention of many scholars (Chambers, 2011; Teitelbaum, Elders & Alavian, 2012; Arnold, 2012). Since the reform and opening up, China's economy develops rapidly and the financial markets become more and more prosperous (Hasan, Wachtelc & Zhou, 2009). The fictitious capital markets represented by bank capital, stocks and bonds play an increasingly important role in Chinese economy, which not only directly changed the macro-economy environment but also reduce the effectiveness of monetary policy with money supply as an intermediary (Zhang & He, 2015). This poses new challenges to the implementation and stability of China's monetary policy. In the context of expanding fictitious economy, the speculative real estate bubble is getting bigger and bigger, which greatly threatens the sustainable development of China's economy in the future. As one of the important measures to regulate macroeconomy, monetary policy and money supply play an important role in the operation of national economy (Popqueras & Sanches, 2013). Asset price transmission channel have become an important channel for the transmission of monetary policy, which is further transmitted to the real economy after it is transmitted to real estate prices (Gallent et al., 2017).

The development of modern fictitious economy and credit money has a certain impact on the effectiveness of monetary policy. The feasibility of using money supply as an intermediate target of monetary policy is declining. At present, there is no broad consensus on the definition and measurement of fictitious economy, and it is still at an exploratory stage. However, it must be recognized that real economy is no longer the only economic form in China. The impact of fictitious economy and fictitious capital on monetary policy should not be ignored. It is biased to unilaterally discuss the regulatory role of monetary policy on housing prices. When scholars carry out empirical research on the relationship between money supply and price, they often choose M1 (narrow money supply) or M2 (broad money supply) as a measurement index of money supply and seldom consider the impact of fictitious economy on housing prices (Wu, Rui & Wu, 2012). In fact, the expansion of fictitious capital is often accompanied by the inflation of fictitious value in real estate industry. So, it is necessary to study the impact of money supply on housing prices under the expansion of fictitious economy. This study has a more in-depth understanding of the effectiveness of money supply on housing price regulation, and provides some empirical support for the theoretical study of the fictitious economy and the formulation of government housing price control policies.

The monthly data in this study is obtained from the website of People's Bank of China, China Financial Statistical Yearbook, CEIC database and China Statistical Yearbook from January 2006 to December 2016. In this paper, we use VAR model, namely vector autoregressive model, to analyze the long-term relationship between housing price and money supply and the short-term dynamic adjustment under the condition of fictitious economy expansion. The VAR model is often used to predict interdependent time-series systems and analyze the dynamic effects of stochastic disturbances on a variable system. It is to build a model based on the statistical properties of data so as to extend the univariate autoregressive model to a "vector" autoregressive model constituted by multiple time series variables. This study uses STATA software to estimate the dynamic relationship of endogenous variables in the model and analyze the dynamic impact of stochastic disturbance on the variable system, thus further explain the impact of changes in the volume of money on housing prices under the condition of fictitious economy expansion. This study selects housing prices as dependent variabble and money supply, the ratio of bank deposit and loan difference, growth rate of the aggregate value of listed stock in Shanghai Stock Exchange and Shenzhen Stock Exchange, inflation rate and interest rate as independent variables.

VAR model, Granger causality analysis, impulse response analysis and variance decomposition analysis are used to explore the impact of money supply on housing prices under the conditions of fictitious economy expansion. What's more, the different influence of ratio of bank deposit and loan difference, growth rate of the aggregate value of listed stock in Shanghai Stock Exchange and Shenzhen Stock Exchange, inflation rate and interest rate on housing prices are discussed. It is found that under the condition of fictitious economy expansion, the effectiveness of monetary policy is reduced in the short term and often lags behind the policy itself. There is a two-way Granger causality between money supply and the ratio of bank deposit and loan difference and CPI. Loose monetary policy fail to boost market liquidity, but lead to a huge amount of money supply and rising CPI rising, thus become one of the important factors pushing up housing prices. Moreover, the rise of fictitious capital in banks and stock markets will lead to the rise of housing prices to some extent. In the short term, the fictitious economy plays the most important role in promoting housing prices, while money supply has the least influence on housing prices. The VAR model shows that the effect of money supply on housing prices has been weakened by the expansion of fictitious economy in the short term. Therefore, when analyzing the effect of government's monetary policy, we should not only focus on the changes of total money supply, but also need to pay attention to the flow of money supply in the historical background of fictitious economy expansion, so as to formulate a more effective and reasonable housing price control policies.

Based on the results of empirical analysis, some policy recommendations are proposed. Firstly, Chinese government should rationally control the rapid rise of the money supply and help housing prices realize the return of reasonable value. Money supply is an important tool for the government to regulate macroeconomic operation. According to the results of Granger causality analysis, there is a a two-way Granger causality between money supply and housing prices. The central bank should rationally control the total money supply through adjustments in legal deposit-reserve ratio, rediscount rate and open market operations, so as to reduce the rising speed of housing prices and minimize the financial risks in real estate industry. Moreover, the government should actively crack down the speculation in real estate market and rectify order in the real estate market, thereby reducing the fictitious level of real estate transactions and achieving a scientific and reasonable housing price. Secondly, the central bank should timely guide the flow of money supply and actively adjust the money supply structure. Government should properly guide the currency flow to the real economy sector rather than the fictitious economy sector by various polices such as tax reduction, policy support, interest rate concessions and reduce the inhibitory effect of the rapid development of fictitious economy on monetary policy. At the same time, it is necessary to enrich the currency adjustment tools and enhance the role of interest rates as an intermediary of monetary policy so as to achieve rationalization of currency supply and structure. Thirdly, under the premise of stepping up supervision and risk control, financing institution should improve the ability to serve real economy and provide more financing support to industrial entity, so as to realize the rational distribution of funds in all industries of the national economy instead of focusing too much on the real estate industry. What's more, government should avoid over-financing and reduce artificial control over the market.

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