

# Household Background Risk and Self-Housing Liability

## —Theoretical and Empirical Research Based on CHFS Data

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### ABSTRACT

The potential motivation for families to bear self-housing liabilities is to hedge background risks. Probit and Tobit models are established based on the data of China Household Finance Survey in 2017. The regression results show that households pay more attention to the background risks on the liability side than on the asset side, and the background risks on the liability side will weaken the influence of the background risks on the asset side. In addition, families in all life states will be affected by housing risks and committed expenditures. And the loan constraints have significant life-cycle characteristics. Generally, families had better to use self-housing liabilities at a young age rather than at an old age as much as possible in order to smooth the distribution of background risks in their whole life.

**Keywords:** Background Risk, Self-housing Liability, Hedge, Prospect Theory

### 1. INTRODUCTION

Background risks are the risk exposure of households, composed of series of interrelated and uninsured internal risks, bringing tremendous disruptions to families after long-term accumulation [1-3]. In order to better identify and manage the household background risks, these can be divided into asset side and liability side. On the one hand, asset side background risks include housing risks and liquidity constraints. Compared with other background risks, housing risks profoundly affecting economic decisions are just as important to families as labor income risks [4-7]. While liquidity constraints are closely related to household liquidity assets and directly decide the efficiency of the household asset allocation on the contrary [8-9]. On the other hand, liability side background risks consist of committed expenditures and loan constraints. The former tends to be a payment obligation for the survival and development of households, which will not change in the short term [10]. Correspondently, loan constraints mainly describe the difficulty of household borrowing, which restricts expected net income and risk perception of households [11-14].

Significantly, background risks are complex and multidimensional in the long term, making traditional

methods of risk diversification unsuitable to manage background risks [15]. Because the non-financial market risks widespread in households are independent from endogenous risk and difficult to control [16]. In Chinese families, the housing for personal use is usually the unique and most important asset, bringing about huge risks to residents' income and wealth distribution [17]. Obviously, the liabilities of family housings are almost inevitable and relatively difficult to deleverage, considered as the common long-term financial resources in ordinary households. Therefore, this work proposes that background risks can be hedged by long-term financial resources. Furthermore, this work focuses on the families' owning houses and constructs a rational decision-making model, aimed at maintaining the stable development of households. Specifically, the hedging of background risks can be realized by adjusting self-housing liabilities. And this work will analyze some possible psychological or behavioral biases in the background risk management according to Prospect Theory [18]. Finally, the empirical test of the model is made based on the data from China Household Finance Survey in 2017 (CFHS, 2017).

## 2. EMPIRICAL ANALYSIS

### 2.1 Data Processing

This work investigated the Chinese families owning houses and depended on the survey data of China Household Finance Survey in 2017 (CHFS, 2017). The 3540 families were retained after data cleaning.

### 2.2 Variable Setting

In order to ensure the smooth progress of the test, the

**Table 1.** Variable setting and descriptive statistics

Variable	Assignment description	Mean	S.D	Min	Max
housedebt	1 = participate, 0 = not participate	0.220	0.414	0	1
house_debt	self-housing liabilities / total liabilities	0.198	0.387	0	1
housing risk	self-housing market value / total assets	0.673	0.256	0	0.999
liquidity constraint	number of housings	1.258	0.536	1	5
committed expenditure	ln(monthly house payments + monthly rents)	2.117	3.431	0	10.820
loan constraint	1 = yes, 0 = no	0.126	0.171	0	1
gender	1 = male, 0 = female	0.806	0.396	0	1
age	age of the head of one household in 2017	44.647	10.867	18	80
age2	age*age	2111.435	980.465	324	6400
rural	1 = yes, 0 = no	0.114	0.318	0	1
region	1 = east, 2 = middle, 3 = west	2.415	0.798	1	3
married	1 = yes, 0 = no	0.889	0.315	0	1
education	1~4, the higher the value, the higher the education level of the head	2.087	0.943	1	4
familysize	the number of family members	3.119	1.226	1	10
income	average monthly household disposable income (unit: ¥ 10,000)	0.487	0.550	0	20
income2	income* income (unit: ¥ 10,000* ¥ 10,000)	0.540	6.858	0	400
risk preference	1~5, the higher the value, the higher the risk preference	3.653	1.224	1	5
risky investment participation	1 = participate, 0 = not participate	0.172	0.377	0	1
risky investment proportion	risky financial investments / total financial assets	0.039	0.137	0	1
family culture	1~9, the higher the value, the higher the overall educational level of other family members	2.645	1.133	1	8
GDP2017	growth rate of regional GDP in 2017 (last year = 100)	7.070	1.424	3.6	10.2

explanatory variables set in this paper are the participation variable (housedebt) and the participation proportion variable (house\_debt) of the self-housing liability. The explanatory variables are background risks related to houses, including housing risk, liquidity constraint, committed expenditure and loan constraint. Meanwhile, the other control variables are the relevant variables of family demographic characteristics and socio-economic characteristics. The variable setting and descriptive statistics are shown in Table 1.

Variable	Assignment description	Mean	S.D	Min	Max
CPI2017	growth rate of regional CPI in 2017 (last year = 100)	1.563	0.334	0.9	2.8
houseprice2016	growth rate of average unit selling price of second-hand residential houses from 2015 to 2016	0.084	0.111	-0.037	0.288
houseprice2017	growth rate of average unit selling price of second-hand residential houses from 2016 to 2017	0.207	0.103	-0.008	0.456

### 2.3 Descriptive Statistics

Table 1 indicates that the proportion of households participating in self-housing liabilities is about 22.0% and the value of housing liabilities account for about 19.8% of total household liabilities. From the perspective of region and age structure, self-housing liabilities are prevalent in southwest of China and mostly occur during the age of 27-46. Although the differences of self-housing debts in families with different wealth levels are little, there is a great difference in self-housing liabilities among families with different income levels. From the perspective of background risks, the statistical values of the housing risk indicates that self-housing assets constitute 67.3% of total assets. The liquidity constraint shows that many families have multiple homes and nearly 80% of the surveyed families just have one self-owned housing. The promised expenditure reveals that the monthly payment or rent for houses of most families is about ¥865. In addition, 12.6% of the sample households have loan constraints.

### 2.4 Model Design

Probit model is selected to measure the variable of self-housing liability participation, and the basic formula (1) is followed.

$$\begin{aligned}
 \text{housedebt}^* &= \alpha + \beta_i \text{background\_risk}_i + \gamma Z + \varepsilon \\
 \text{housedebt} &= \begin{cases} 1 & \text{housedebt}^* > \mu \\ 0 & \text{housedebt}^* \leq \mu \end{cases} \quad (1)
 \end{aligned}$$

The housedebt\* is the latent variable of self-housing liability participation and the housedebt is the dummy variable of self-housing liability participation. The background\_risk<sub>i</sub> (i=1,2,3,4) refers to housing risk, liquidity constraint, committed expenditure and loan constraint respectively. In addition, μ is a certain

threshold, Z refers to the control variable, α, β and γ are the estimated parameters, ε is the residual term.

Then Tobit model is selected to measure the variable of self-housing liability proportion, and the the basic formula (2) is followed.

$$\begin{aligned}
 \text{house\_debt}^* &= \alpha + \beta_i \text{background\_risk}_i + \gamma Z + \varepsilon \\
 \text{house\_debt} &= \begin{cases} \text{house\_debt}^* & \text{house\_debt}^* > \mu \\ 0 & \text{house\_debt}^* \leq \mu \end{cases} \quad (2)
 \end{aligned}$$

The house\_debt\* is the latent variable of the self-housing liability proportion, and the house\_debt is the participation proportion of the self-housing liabilities. In addition, other variables have the same meanings as those in formula (1).

## 3. RESULT

### 3.1 Analysis of Regression Results

#### 3.1.1 Full Sample Analysis

It is shown in Table 2 that both housedebt and house\_debt are positively affected by asset side background risks, which include housing risks and liquidity constraints. And housing risks have larger impacts than liquidity constraints. Meanwhile, committed expenditures and loan constraints are significantly positive at a confidence level of 99%, indicating that the impact of loan constraints is greater than that of committed expenditures. However, the introduction of liability side background risks will reduce the sensitivity of households to asset side background risks. Overall, families pay more attention to the background risks on the liability side than on the asset side and tend to use self-housing liabilities to hedge the contingent loss of assets held.

**Table 2.** Results of full sample regression analysis

Explanatory Variable	housedebt	house_debt	housedebt	house_debt	housedebt	house_debt
Model Number	(1)	(2)	(3)	(4)	(5)	(6)
housing risk	1.703***	6.000***	-	-	1.835***	4.684***

Explanatory Variable	housedebt	house_debt	housedebt	house_debt	housedebt	house_debt
Model Number	(1)	(2)	(3)	(4)	(5)	(6)
	(12.638)	(10.569)	-	-	(12.180)	(10.477)
liquidity constraint	0.372***	1.105***	-	-	0.119	0.163
	(5.874)	(4.928)	-	-	(1.541)	(0.857)
committed expenditure	-	-	0.227***	0.617***	0.246***	0.601***
	-	-	(26.891)	(14.831)	(26.782)	(15.075)
loan constraint	-	-	0.994***	2.327***	0.884***	1.752***
	-	-	(7.409)	(6.424)	(6.340)	(5.370)
control variable	yes	yes	yes	yes	yes	yes
obs	3540	3540	3535	3535	3535	3535

\* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001, t values are in parentheses.

### 3.1.2 Sub Sample Analysis

In Table 3, in order to identify different life states, families are divided into four sub samples, which are named life state 1 (18-26 years old), life state 2 (27-46 years old), life state 3 (47-54 years old) and life state 4 (55-64 years old). According to the Chinese society current situation, people experience the first marriage or pregnancy at the age of about 27, send their children away from their original family at the age of about 47, and prepare for retirement at the age of about 55. Moreover, people around 65 years old usually transfer some household assets to offsprings, helping future

generations set up new families.

On the asset side, families will be positively impacted by liquidity constraints only in life state 3, because these families have accumulated a certain amount of tangible and intangible assets and have higher solvency. On the liability side, committed expenditures have a more frequent impact on household self-housing debt decision-making. Considering the significant life-cycle characteristics of loan constraints, families should use self-housing liabilities to hedge background risks at a young age rather than at an old age as much as possible, in order to smooth the distribution of background risks in their whole life.

**Table 3.** Results of sub sample regression analysis

Life State	Life State1		Life State2		Life State3		Life State4	
	housedebt	house_debt	housedebt	house_debt	housedebt	house_debt	housedebt	house_debt
Model Number	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
housing risk	2.888**	4.598*	2.040***	4.266***	1.934***	6.157***	0.935*	5.042*
	(2.811)	(2.492)	(10.078)	(8.700)	(6.076)	(4.904)	(2.234)	(2.114)
liquidity constraint	0.601	0.712	0.024	-0.132	0.412**	1.191*	0.037	0.227
	(1.480)	(1.026)	(0.228)	(-0.622)	(2.759)	(2.506)	(0.145)	(0.185)
committed expenditure	0.303***	0.520***	0.264***	0.538***	0.234***	0.702***	0.201***	0.974***
	(4.609)	(3.389)	(22.374)	(12.880)	(11.568)	(6.288)	(6.645)	(3.370)
loan constraint	-3.112**	-3.975*	0.701***	1.061**	1.540***	3.874***	1.091**	3.813
	(-3.125)	(-2.205)	(3.867)	(3.038)	(4.884)	(3.978)	(2.795)	(1.927)
control variable	yes	yes	yes	yes	yes	yes	yes	yes
obs	153	158	1776	1776	936	936	560	560

\* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001, t values are in parentheses.

### 3.2 Robustness Test

The robustness test is carried out by deleting special samples, adding control groups and changing measurement methods. Table 4 illustrates that the long-term liability is more suitable for hedging

property-related background risks than the short-term liability or medium-term liability. And other results are basically consistent with the previous text, showing that the analysis results in this paper are representative and reliable.

**Table 4.** Partial results of robustness check

Group	Benchmark Group: Long-Term Liability		Control Group 1: Medium-Term Liability		Control Group 2: Short-Term Liability	
	housedebt	house_debt	auto&edudebt	auto&edu_debt	creditcarddebt	creditcard_debt
Explanatory Variable	(15)	(16)	(17)	(18)	(19)	(20)
housing risk	1.827*** (11.667)	5.007*** (9.800)	1.255*** (10.542)	-1.263** (-2.849)	-0.565*** (-4.628)	-0.819* (-2.293)
liquidity constraint	0.139 (1.718)	0.214 (0.999)	0.114 (1.930)	0.049 (0.234)	-0.080 (-1.310)	-0.290 (-1.643)
committed expenditure	0.241*** (25.336)	0.638*** (13.845)	0.016* (2.004)	-0.012 (-0.395)	0.018* (2.293)	-0.015 (-0.722)
loan constraint	0.723*** (4.929)	1.643*** (4.373)	0.239 (1.440)	-0.334 (-0.543)	-0.381* (-2.183)	0.009 (0.019)
control variable	yes	yes	yes	yes	yes	yes
obs	3238	3238	3238	3238	3238	3238

\* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001, t values are in parentheses

#### 4. CONCLUSION

This work tests that the potential motivation for households to bear self-housing liabilities is to hedge background risks. The long-term stable background risks need to be hedged with self-housing liabilities, which belong to one kind of long-term financial resources. Households tend to avoid risks when managing asset side background risks. But households will become loss aversion when managing liability side background risks. Considering the significant life-cycle characteristics of loan constraints, families should use self-housing liabilities to hedge background risks at a young age rather than at an old age as much as possible, in order to smooth the distribution of background risks in their whole life.

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