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An Empirical Study on the Impact of Tenure Choice on Saving for Chinese Households

Chu-Chia Lin
Professor of Department of Economics, National Chengchi University. Address: No. 64, Sec. 2, Zhinan Road, Wenshan District, Taipei City, Taiwan. Email: nccut001@nccu.edu.tw

Po-Sheng Lai
Master of Arts, Department of Economics, National Chengchi University. Address: No. 64, Sec. 2, Zhinan Road, Wenshan District, Taipei City, Taiwan. Email: 104258035@nccu.edu.tw

The purpose of this paper is to estimate the impact of tenure choice on saving for Chinese households. Since housing expenditure usually accounts for a large portion of household spending, households need to consider how much they have in order to save for future housing spending when they decide on their daily expenditures, including food, clothing, transportation, education, leisure, and so on and so forth. We estimate the tenure choice behavior of Chinese households by first, applying a data set from the China Household Finance Survey and separating households into three types of tenure choice, namely, renters, owner-occupied with a mortgage, and owner-occupied without a mortgage. Then, we estimate the actual impact of tenure choice on saving by applying the Heckman two-stage model. Our estimations show two important results. First, the coefficients of the inverse Mills ratio are significant which implies that a two-stage estimation model is appropriate. Secondly, the estimated coefficients for the factors that affect saving behavior under the two-stage model are significantly different from those under a conventional model. The result shows that, without considering tenure choice, the conventional method of estimation for factors that affect saving behavior will be biased.

Keywords

Tenure Choice, Saving Behavior, Heckman Two-Stage Model

1. Introduction

To own or to rent a dwelling unit is often a crucial decision for every household. When a household decides to buy a house, they need to ensure that there is an adequate down payment and also make plans for the future mortgage payments. It is clear that tenure choice not only impacts the housing expenses of a household, but also other expenses, as well as savings. In other words, tenure choice and daily consumption (and saving) are simultaneously decided for every household.

The Chinese economy has experienced an unprecedented high growth rate which parallels the housing price. One significant point of the Chinese economy is that the saving rate was as high as 46% in 2015, which is the highest saving rate among Asian countries. Why is the saving rate so high in China? Is the unprecedented high housing price one of the reasons that explain for the high saving rate? To what extent does the high housing price affect the tenure choice, consumption, and saving behavior of households?

Many studies in the extant literature have discussed the tenure choice behavior of households. For instance, Green and White (1997) find that the education of children is an important factor on the tenure choice of households. While Carter (2011) argues that a male or female household head is not important in deciding tenure choice and that the total income of the family is more crucial, Painter and Lee (2009) also find that the age of the household head is not significant for tenure choice; however, changes in the household characteristics are more important.[1]

Moreover, Yoshikawa and Ohtake (1989), Tachibanaki and Shimono (1986), and Tachibanaki (1994) analyze the relationship among economic development, housing price, and tenure choice decision in Japan. They find that the number of family members, number of years of marriage, and family income all have positive impacts on families who own a dwelling unit. Park and Kim (2006) and Kim and Jeon (2012) study similar topics in Korea and find that household age, education, and income have positive influences on owner-occupied dwellings, while housing price has a negative impact. Zhou (2011), Huang and Clark (2002), and Wang and Otsuki (2015) analyze tenure choice in China. In addition to household income, education, age, and housing price, they also find that institutional change is crucial for tenure choice. Lin (1994) studies the relationship between household characteristics and tenure choice in Taiwan, including income, age, education, and marriage. Lin and Chen (2005) and Shieh et al. (2009) analyze the different behaviors of tenure choice between

[1] Green and Hendershott (2001), Boehm and Schlottmann (2004, 2014), Seko and Sumita (2007), and Aizawa and Helble (2016) also provide a profound discussion on tenure choice related topics, such as the financial market, employment conditions, and household mobility on tenure choice.

generations and find that while housing price is substantially high, income transfer between generations is an important factor that affects tenure choice.

In addition to household characteristics, there are studies in the literature that have analyzed the relationship between financial market situation and saving behavior on tenure choice. For example, Krumm and Kelly (1989) point out that down payment is often a consideration for a household to own a house, and so they have to save a large sum of money before considering the purchase of a house. Moreover, after securing a house, the household has to reduce expenses in order to pay for the monthly mortgage. Therefore, it is clear that tenure choice has a significant influence on the saving behavior of households. Campbell and Cocco (2007) apply a data set from the UK to study how housing price affects consumption behavior and find that the impact is more on younger families.

Tachibanaki and Shimono (1986) and Tachibanaki (1994) find that most Japanese families have to reduce the amount spent on daily expenses and save more if they want to buy a house in the future. The impact is so strong that they call this notion "forced saving". Moriizumi (2003) obtains a very similar result. Applying the same idea, Lin and Chen (1998) find that forced saving is also very significant in Taiwan. Lin et al. (2000) and Chen and Chang (2000) find that families in owner-occupied dwellings with a mortgage have a higher saving rate than those of owner-occupied dwellings without a mortgage, while renters have the highest saving rate. The result again reinforces the prevalence of forced saving in Taiwan. Applying a quantile regression, Chen (2007) finds that the forced saving phenomenon is less serious for better off families.

As for China, there are some studies in the literature that have already examined the reasons for the high saving rate; for instance, Chang et al. (2014) find that one of the reasons that China has a high saving rate is because there are a large number of workers who are transitioning from agricultural employment to manufacturing work which results in a much higher income. Furthermore, Chamno et al. (2013) argue that since the uncertainty of income from manufacturing jobs is very high in China, the saving rate is also relatively high too. Chang (2012) applies the precautionary demand for the saving theory to explain for the high saving rate in China. In addition to precautionary saving for education, medical expenses and retirement, Chang (2012) finds that unstable market conditions and lack of a social security system are also important reasons for the high saving rate in China. Some in the literature also analyze the relationship between housing price and saving rate. For instance, Shieh and Shen (2012) argue that the marketization of education, medical expenses, and housing in 1997 was the key for Chinese households to maintain a high saving rate because they have to save more in order to pay for the future. Chen and Chiu (2011) analyze the impacts of high housing price on the different generations, and find that young households have to save more in order to purchase a future dwelling unit. Moreover, Chen and Yang (2013) find that the impact of high housing price on saving is mainly on households with low

income, no property, or a smaller dwelling unit. However, in applying a household income survey in China, Chao et al. (2014) was the only study which finds that the relationship between high housing price and high saving rate is somewhat ambiguous.

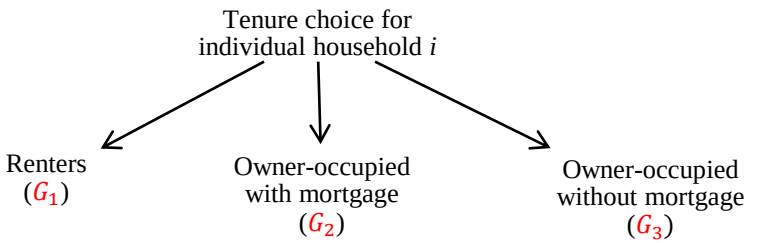
In the above literature, most have found that high housing price is one of the reasons that explain for a high saving rate in China. However, there are a lack of studies in the literature that examine how housing price affects tenure choice and tenure choice affects saving behavior. In this paper, we investigate how household characteristics affect tenure choice and the extent that tenure choice affects saving behavior in China simultaneously. As we have mentioned above, tenure choice, household consumption, and saving should be simultaneously determined. Without considering these factors jointly, the estimation of factors that affect saving behavior could be seriously biased.

We will discuss the empirical model in Section 2. The data and basic statistics will be provided in Section 3, and the empirical results in Section 4. The paper will conclude in Section 5.

2. Estimation Model for Tenure Choice and Saving Behavior

First, per Lin (1994) and Lin et al. (2000), we assume that there are three types of tenure choices, namely, renters, owner-occupied with a mortgage, and owner-occupied without a mortgage. For each individual household i, $i \in I$, where I is the total number of households. They face j types of tenure choices, where $j = 1,2,3$. The characteristics vector for each j-th type of tenure choice is G_j, where $G_j = (g_{j1}, \cdots, g_{jm})$, and g_{jk} is the κ-th individual characteristic for j-th type of tenure choice. The structure is shown as Figure 1.

Figure1 Three Types of Tenure Choices



According to McFadden (1974), when household i chooses the j-th type of tenure, their utility is shown by using a random utility function as U_j^i, where

U_j^i is composed of the characteristics vector X^i of household i, where $X^i = (x_1^i, \cdots, x_n^i)$, and x_k^i is the κ-th characteristic of individual i, and the characteristics vector G_j of choice j. There are two parts of this random utility function; one is an observable utility function, V_j^i, and the other is random and unobservable, ε_j^i, namely,

$$U_j^i(G_j, X^i) = V_j^i(G_j, X^i) + \varepsilon_j^i(G_j, X^i) \tag{1}$$

Furthermore, we assume that ε_j^i follows an identical independent Gumbel distribution, and then we obtain a multinomial logit model with a discrete tenure choice. Moreover, the probability of individual i choosing the j-th choice, P_j^i, is

$$P_j^i = \frac{\exp(\delta v_j^i)}{\sum_{j \in J} \exp(\delta v_j^i)} \tag{2}$$

where Equation (2) is a multinomial logit model, as shown in Figure 1.[2]

In order to examine the impact of tenure choice on household saving behavior, following Lee and Trost (1978), we use a joint decision model for tenure choice and saving. According to Figure 1, the saving function, S_j^i, for household i who chooses the j-th type of tenure is:

$$\begin{aligned}
S_1^i &= \alpha_{10} + \alpha_{11} g_{11} + \cdots + \alpha_{1m} g_{1m} + \beta_{11} x_1^i + \cdots + \beta_{1n} x_n^i + \varepsilon_1^i \\
&\quad iff \;\; \alpha_{10} + \alpha_{11} g_{11} + \cdots + \alpha_{1m} g_{1m} + \beta_{11} x_1^i + \cdots + \beta_{1n} x_n^i \le \underline{V}^i \\
S_2^i &= \alpha_{20} + \alpha_{21} g_{21} + \cdots + \alpha_{2m} g_{2m} + \beta_{21} x_1^i + \cdots + \beta_{2n} x_n^i + \varepsilon_2^i \\
&\quad iff \;\; \underline{V}^i < \alpha_{20} + \alpha_{21} g_{21} + \cdots + \alpha_{2m} g_{2m} + \beta_{21} x_1^i + \cdots + \beta_{2n} x_n^i \le \overline{V}^i \\
S_3^i &= \alpha_{30} + \alpha_{31} g_{31} + \cdots + \alpha_{3m} g_{3m} + \beta_{31} x_1^i + \cdots + \beta_{3n} x_n^i + \varepsilon_2^i \\
&\quad iff \;\; \alpha_{30} + \alpha_{31} g_{31} + \cdots + \alpha_{3m} g_{3m} + \beta_{31} x_1^i + \cdots + \beta_{3n} x_n^i > \overline{V}^i
\end{aligned} \tag{3}$$

where lower-index j (=1,2,3) represents the three types of tenure choices, namely, renters, owner-occupied with a mortgage, and owner-occupied without a mortgage, respectively; $g_{j1}, \ldots, g_{jm}$ represent m types of characteristics for choice j; $x_1^r, \ldots, x_n^r$ represent n types of household characteristics for individual household i; $\underline{V}^i$ and $\overline{V}^i$ are the boundaries of the tenure choice; and ε_j^i is the error term for individual i who chooses the j-th choice.

[2] One important assumption with the use of a multinomial logit model is the assumption of the independence of irrelevant alternatives, IIA, which assumes that the relationships among the alternatives are independent of each other. In this study, we have applied the Hausman test to examine if IIA holds for our data set. The Hausman test shows that IIA holds, so we should have no problem using the multinomial logit model here.

Since Equation (3) is a truncated model, the expected value of the error terms will not be equal to zero, i.e.

$$
\begin{aligned}
&E\left(\varepsilon_1^i \mid \alpha_{10}+\alpha_{11}g_{11}+\cdots+\alpha_{1m}g_{1m}+\beta_{11}x_1^i+\cdots+\beta_{1n}x_n^i \le \underline{V}^i\right)\neq 0\\
&E\left(\varepsilon_2^i \mid \underline{V}^i < \alpha_{20}+\alpha_{21}g_{21}+\cdots+\alpha_{2m}g_{2m}+\beta_{21}x_1^i+\cdots+\beta_{2n}x_n^i \le \overline{V}^i\right)\neq 0 \quad (4)\\
&E\left(\varepsilon_3^i \mid \alpha_{30}+\alpha_{31}g_{31}+\cdots+\alpha_{3m}g_{3m}+\beta_{31}x_1^i+\cdots+\beta_{3n}x_n^i > \overline{V}^i\right)\neq 0
\end{aligned}
$$

Equation (4) implies that the error terms ε_1^i, ε_2^i, ε_3^i will not only be influenced by the explanatory variables $g_{11},\cdots,g_{1m}$ and $x_{11},\cdots,x_{1n}$, but also by the factors that affect tenure choice, and thus by the truncated values $\underline{V}^i$ and $\overline{V}^i$. Therefore, a direct estimation based on Equation (3), without considering the truncation problem, will be a biased and inconsistent result. In order to obtain an unbiased and consistent result, one has to modify the equation by adding a probability term (known as the inverse Mills ratio), so that the correct expected value for the truncated observations can be obtained.[3]

Tenure choice

For each individual household i, the probability of choosing rental housing, owner-occupied with a mortgage, and owner-occupied without a mortgage is P_1^i, P_2^i, and P_3^i respectively. By using a multinomial logit model, the tenure choice for household i could be written as Equation (5), where owner-occupied with a mortgage (P_2) is the reference group in this study.

$$
\begin{aligned}
Tenure\left(\frac{P_1^i}{P_2^i}\right) &= r_{10}+r_{11}g_{11}+\cdots+r_{1m}g_{1m}+\delta_{11}x_1^i+\cdots\delta_{1n}x_n^i+\eta_1^i\\
Tenure\left(\frac{p_3}{p_2}\right) &= r_{30}+r_{31}g_{31}+\cdots+r_{3m}g_{3m}+\delta_{31}x_1^i+\cdots\delta_{3n}x_n^i+\eta_3^i
\end{aligned} \quad (5)
$$

Finally, following Heckman (1979), the two-stage model in this study is summarized as follows. In the first stage, we apply a multinomial logit model to estimate the tenure choice for each household *i*, which is a function of the characteristics of household *I*, as in Equation (5).

After obtaining the estimated coefficient in the tenure choice equation, as $\hat{d}_1 = \left(\hat{r}_{10},\cdots,\hat{r}_{1m},\hat{\delta}_{11},\cdots,\hat{\delta}_{1n}\right)$ and $\widehat{d}_3 = \left(\hat{r}_{30},\cdots,\hat{r}_{3m},\hat{\delta}_{31},\cdots,\hat{\delta}_{3n}\right)$, we calculate two inverse Mills ratios for each household *i* as

[3] For details on the relationship between the inverse Mills ratio and truncated model, please refer to Wooldridge (2009), p. 589.

$$\text{MILLSP1} = \frac{\phi(d_1)}{\Phi(d_1)}$$
$$\text{MILLSP3} = \frac{\phi(d_3)}{\Phi(d_3)} \tag{6}$$

where $\phi(\widehat{d_1})$and $\Phi(\widehat{d_1})$ is a logistic probability density function (PDF) and a cumulative density function (CDF) for household i with specific characteristics.[4]

In the second stage, after obtaining the two inverse Mills ratios, we rewrite the saving function for household i, S^i, as Equation (7):

$$S^i = \alpha_0 + \alpha_1 g_1 + \cdots + \alpha_m g_m + \beta_1 x_1^i + \cdots + \beta_n x_n^i + \delta_1 \cdot \frac{\phi(d_1)}{\Phi(d_1)} + \delta_2 \cdot \frac{\phi(d_3)}{\Phi(d_3)} + \varphi_i \tag{7}$$

The estimated coefficients in this saving function will be unbiased and consistent with two adjusted terms, MILLSP1 and MILLSP3.

3. Data and Basic Statistics

The data set that we use in this study is from the China Household Financial Survey (CHFS), which was conducted by the Southwestern University of Finance and Economy in Chengdu, Sichuan province, in 2012. There are 8,437 households in the original data set, and we removed those with missing data. After cleaning the data set, we employ 5,503 households in our data set, in which 740 (13.44%) observations are renters, 498 (9.05%) are owners with a mortgage, and 4,265 (79.50%) are owners without a mortgage.

The variables are defined as follows:

AGE: age of household head in 2011.

AGRIHOUSE: a dummy variable, if the household is non-agricultural, then AGRIHOUSE=1; otherwise 0.

CITY: a dummy variable, if the household is located in the city, then CITY=1; otherwise 0.

FINANCE: total financial assets,[5] unit: RMB.

[4] Since there are three types of tenure choices, we define renters as 1, owners with a mortgage as 2, and owners without a mortgage as 3. By taking owners with a mortgage as the standard group, we will obtain two inverse Mills ratios for the first group (renters) and the third group (owners without a mortgage).

[5] Financial assets include stocks, bonds, mutual funds, derivatives, futures, foreign exchange, gold, and others, except for bank deposits.

FSAVINGS: forced saving, equals to SAVINGS plus mortgage payment, unit: RMB.
GENDER: a dummy variable, if the household head is male, then GENDER=1; otherwise 0.
HSENUMBER: the total number of dwelling units owned by the household.
HOUSEPRICE: price of house, unit: RMB.
INCOME: total household annual income, unit: RMB.
MARRIAGE: a dummy variable, if the household head is married, then MARRIAGE=1; otherwise 0.
PSNNUMBER: total number of individuals in the family.
REG1: a dummy variable, if the household is located in Beijing, Shanghai, Tianjin, and Chongqing, then REG1=1; otherwise 0.
REG2: a dummy variable, if the household is located in the east region (Hebei, Shandong, Jiangsu, Zhejiang, Guangdong, and Fujian), then REG2=1; otherwise 0.
REG3: a dummy variable, if the household is located in the central region (Henan, Hubei, Hunan, Jiangxi, Anhui, and Shanxi), then REG3=1; otherwise 0.
REG4: a dummy variable, if the household is located in the northeast region (Heilongjiang, Jilin, and Liaoning) then REG4=1; otherwise 0. (The standard group is the northwest region, including Sichuan, Gansu, Qinghai, Shaanxi, Guizhou, Yunnan, and Guangxi.)
SAVINGS: total amount of household savings,[6] unit: RMB;
SCHOOLING: level of schooling of household head; primary school=6, junior high=9, senior high=12, Bachelor=16, Masters=18, and PhD=24.
TENURE: a discrete variable, renters=1, owner-occupied with a mortgage=2, and owner-occupied without a mortgage=3.

In Table 1, one can see that the average family size (PSNNUMBER) is 3.6 persons, while renters have the smallest family size with 3.0 persons. The largest family size is 13 persons. The majority of the household heads (AGE) are male at 73.1%, while owners without a mortgage comprise the highest percentage male head at 74.9%. The average age of the household head is 44.9 years of age, in which the renters have the youngest household head at 39.1 years old. The average schooling (SCHOOLING) is 9.8 years, while owners with a mortgage have the most schooling 11.6 years. There are 52.2% households from the agricultural sector (AGRIHOUSE), while 47.8% are from the non-agricultural sector. Finally, 91.6% of the household heads (MARRIAGE) are married, although renters have a lower marriage rate at 82.7%.

[6] In the original questionnaire, the total saving is defined as the amount of money that the household saves in the bank, including saving and time deposits.

Table 1 Basic Statistics

Variable	Total sample	Max	min	Renters	Max	min	Owner-occupied with mortgage	Max	min	Owner-occupied without mortgage	Max	min
TENURE	2.641	3	1	1	1	1	2	2		3		
	(0.707)											
PSNNUMBER	3.634	13	1	3.039	9	1	3.504	9	1	3.752	13	1
	(1.404)			(1.322)			(1.272)			(1.405)		
GENDER	0.731	1	0	0.667	1	0	0.668	1	0	0.749	1	0
	(0.444)			(0.471)			(0.471)			(0.434)		
AGE	44.927	60	25	39.112	60	25	40.775	60	25	46.420	60	25
	(9.165)			(9.236)			(8.472)			(8.668)		
SCHOOLING	9.838	24	0	10.792	24	0	11.580	24	0	9.469	24	0
	(3.772)			(4.020)			(3.805)			(3.636)		
MARRIAGE	0.916	1	0	0.827	1	0	0.912	1	0	0.932	1	0
	(0.278)			(0.378)			(0.284)			(0.252)		
AGRIHOUSE	0.478	1	0	0.514	1	0	0.657	1	0	0.451	1	0
	(0.500)			(0.500)			(0.475)			(0.498)		
HSENUMBER	1.100	5	0	0.532	3	0	1.200	4	1	1.186	5	1
	(0.520)			(0.591)			(0.487)			(0.443)		
CITY	0.634	1	0	0.904	1	0	0.747	1	0	0.574	1	0
	(0.482)			(0.295)			(0.435)			(0.495)		
REG1	0.144	1	0	0.270	1	0	0.195	1	0	0.116	1	0
	(0.351)			(0.444)			(0.396)			(0.321)		
REG2	0.290	1	0	0.307	1	0	0.295	1	0	0.287	1	0
	(0.454)			(0.461)			(0.457)			(0.452)		

(Continued…)

(Table 1 Continued)

Variable	Total sample	Max	min	Renters	Max	min	Owner-occupied with mortgage	Max	min	Owner-occupied without mortgage	Max	min
REG3	0.309 (0.462)	1	0	0.228 (0.420)	1	0	0.187 (0.390)	1	0	0.338 (0.473)	1	0
REG4	0.128 (0.334)	1	0	0.131 (0.338)	1	0	0.118 (0.323)	1	0	0.129 (0.335)	1	0
HOUSEPRICE (RMB (000s))	332716 (583141)	5,000	0	144088 (336249)	3,000	0	616486 (802428)	5,000	100	332309 (573200)	5,000	100
INCOME (RMB (000s))	18433.04 (24153.85)	125	0	19871.86 (27456)	124	0	28797 (30681)	123	0	16973 (22302)	125	0
SAVINGS (RMB (000s))	37185.84 (187580)	9,600	0	48430.76 (172522)	2,052	0	29562 (87044)	1000	0	36124 (198320)	9,600	0
FSAVINGS (RMB (000s))	51203.98 (205333)	9,600	0	61406.84 (186528)	2,052	0	120461 (229082)	2,530	0	41346 (203913)	9,600	0
FINANCE (RMB (000s))	18761.09 (103343)	2,400	0	29026.03 (141756)	2,200	0	25950 (107231)	1,579	0	16140 (94480)	2,400	0
SAVING RATE (%)	137.7	-	-	243.7	-	-	102.6	-	-	212.8	-	-
FSAVING RATE (%)	201.7	-	-	309.0	-	-	418.3	-	-	243.6	-	-
Sample size	5,503 (100%)	-	--	740 (13.44%)	-	-	498 (9.05%)	-	-	4,265 (79.50%)	-	-

Note: The numbers in the parentheses are standard deviations.

There are 93% of the households that own a house, while 21.9% have more than one house. The owners with a mortgage own the highest average number of dwelling units (HSENUMBER) at 1.2 units, while the renters own 0.5 only. The highest number of dwelling units owned by a family is 5 units. The average housing price (HOUSEPRICE) is RMB333,000, while owners with a mortgage have the highest house value at RMB616,000. The most expensive housing unit is worth RMB5 million. The average household annual income (INCOME) is RMB18,433, while the owners with a mortgage have the highest annual income at RMB28,797 and the owners without a mortgage have the lowest income at RMB16,973, and the highest annual income is RMB125,000 in our data set. The average total savings (SAVINGS) is RMB37,186, while the renters have the highest amount of saving at RMB48,431. The highest amount of savings of a family is RMB9.6 million. The average amount of financial assets (FINANCE) is RMB18,761, while the renters have the most financial assets at RMB29,026. The largest amount of financial assets is RMB2.4 million. Finally, the average forced savings (FSAVINGS) is RMB51,204, while the owners with a mortgage have the highest total amount of forced savings at RMB120,461, which is almost triple that of owners without a mortgage at RMB41,347.

Finally, in terms of saving rate, the renters have the highest saving rate at 243.7%, while the owners with a mortgage have the lowest one at 102.6%. This result is somewhat strange since owners with a mortgage have the highest annual income at RMB28,789. However, if we include mortgage payment as a forced saving, then the owners with a mortgage immediately have the highest forced saving rate as 418.3%, while the renters have the second highest forced saving rate at 309.4%, and the owners without a mortgage have the lowest at 243.6%.[7] The result indicates that forced saving is quite significant for owners with a mortgage since they have to pay a large sum for the mortgage on a monthly basis. At the same time, forced saving is also crucial for renters since they have to save money if they want to buy a dwelling unit in the future.

4. Empirical Results

Stage One: Tenure Choice

The estimated results of tenure choice from Equation (5) are shown in Table 2, where there are three types of tenure choices and owner-occupied with a mortgage is used as the standard group; therefore, we obtain two sets of estimated coefficients. Table 2 shows that the coefficient of PSNNUMBER for renters is significantly less than zero (-0.2145), which implies that a family with fewer individuals has a greater chance of being a renter. In the meantime, AGE also has a negative and significant coefficient (-0.2882) which also implies that

[7] The relationship between saving and forced saving with income that we have here is quite similar to that in Lin et al. (2000), although the definition of saving is different from theirs.

a young head of the household will have a greater chance of being a renter. The same applies to AGRIHOUSE (-1.2187) and HSENUMBER (-0.9813). The results show that a household with a small family size, young head of the household, in agricultural employment, and with fewer dwelling units will tend to be a renter and less likely to be an owner with a mortgage.

Table 2 Regression on Tenure Choice
Dependent variable: TENURE

	Renters		Owner-occupied without mortgage	
Independent Variable	Coefficient	z value	Coefficient	z value
PSNNUMBER	-0.2145***	-3.16	0.0294	0.66
GENDER	0.2847*	1372	0.1633	1.49
AGE	-0.2882***	-3.17	0.0596***	9.84
SCHOOLING	-0.0099	-0.36	-0.0648***	-3.57
MARRIAGE	0.0669	0.26	0.2021	1.06
AGRIHOUSE	-1.2187***	-6.11	-0.1102	-0.77
HSENUMBER	-0.9813***	-4.49	0.1828	1.63
CITY	2.6564***	11.02	0.0914	0.64
REG1	2.4313***	7.59	0.8578***	4.58
REG2	1.8501***	6.36	0.9488***	6.09
REG3	1.5466***	5.26	1.1394***	7.13
REG4	0.8419**	2.42	0.7923***	4.22
ln(HOUSEPRICE)	-0.9236***	-14.96	-0.4203***	-7.80
ln(INCOME)	-0.0796***	-4.85	-0.0268**	-2.31
ln(FINANCE)	-0.0564***	3.31	0.0202*	1.78
Constant	11.0408***	12.33	4.0913***	5.78
Pseudo R^2	0.3660			
Sample size	5,503			

Notes: (1) The coefficients with ** and *** are significantly different from 0 at the 95% and 99% significance levels, respectively.
(2) Variables with ln(.) apply a natural logarithm.

For owners without a mortgage, one can see in Table 2 that AGE has a positive and significant coefficient of 0.0596, while SCHOOLING (-0.0648), HOUSEPRICE (-0.4203), and INCOME (-0.0268) all have negative and significant signs. The results show that an older head of the household who is less educated with a lower income in a market with a lower housing price will tend to be an owner without a mortgage and less likely to be an owner with a mortgage.

The empirical results show a very clear picture of a rental family, owners with a mortgage, and owners without a mortgage and so their saving behavior will be quite different too. Furthermore, to avoid a possible multicollinearity

problem, we rerun the tenure choice function by using only significant variables in Table 2 and the results are shown in Table 3.[8] Then, we use the estimated results in Table 3 to calculate the inverse Mills ratios for renters and owners without a mortgage with Equation (6). Finally, we put the two calculated inverse Mills ratios into a saving function and then we can examine the impact of tenure choice on the saving behavior with Equation (7).

Table 3 Adjusted Regression on Tenure Choice
Dependent variable: TENURE

	Renters		Owner-occupied without mortgage	
Independent Variable	Coefficient	z value	Coefficient	z value
AGE	-0.0383***	-4.57	0.6652***	11.54
REG1	3.0724***	10.18	0.7559***	4.13
REG2	2.4530***	8.94	0.9609***	6.27
REG3	1.9409***	6.98	1.1284***	7.17
REG4	1.3338***	4.18	0.6590***	3.63
ln(HOUSEPRICE)	-0.9556***	-18.43	-0.4690***	-9.74
ln(INCOME)	-0.0931***	-5.92	-0.0308***	-2.70
ln(FINANCE)	0.0536***	3.34	0.1245	1.13
Constant	11.1880***	14.82	4.4204***	6.84
Pseudo R^2	0.3160			
Sample size	5,503			

Notes: (1) The coefficients with ** and *** are significantly different from 0 at the 95% and 99% significance levels, respectively.
(2) Variables with ln(.) apply a natural logarithm.

Stage Two: Saving Function

We show the regression results of those with and without an inverse Mills ratio in Table 4 to show the difference for the existence of inverse Mills ratios (and thus the impact of tenure choice on saving). First, the adjusted R-square is increased from 0.1151 to 0.1788 with the inverse Mills ratios (MILLSP1 and MILLSP3). Secondly, almost all of the coefficients are significantly different from zero in the function with inverse Mills ratios, and some coefficients have also largely changed (some even change signs), compared to the coefficients

[8] We have also applied the estimated coefficients for tenure choice in Table 2 and then to calculate the saving functions in Table 4. We find that the estimated coefficients for explanatory variables do change a little, but the coefficients of ln(HOUSEPRICE) and ln(INCOME) are quite similar as in Table 4. This means that our conclusion still holds in that the impact of tenure choice on saving behavior is significant and the estimated income elasticity of saving will be biased without considering tenure choice. The authors thank for the comment on this point from one of the referees, so that the result could be made more clear here.

without inverse Mills ratios. The estimated results clearly show that tenure choice will have a significant influence on saving behavior.

Table 4 Regression on Saving
Dependent variable: ln(SAVINGS)

	Regression without inverse Mills ratios		Regression with inverse Mills ratios	
Independent Variable	Coefficient	z value	Coefficient	z value
PSNNUMBER	-0.1159**	-2.32	-0.1117**	-2.32
GENDER	0.1860	1.26	0.1117	0.79
AGE	-0.0213***	-2.86	0.7403***	19.35
SCHOOLING	0.2479***	11.73	0.1763***	8.46
MARRIAGE	0.3601	1.49	0.4831**	2.07
AGRIHOUSE	0.6061***	3.55	0.3568**	2.16
HSENUMBER	0.9359***	6.35	0.7375***	5.12
CITY	0.9336***	5.78	0.5425***	3.40
REG1	0.7500***	2.97	-15.9489***	-18.55
REG2	0.6966***	3.23	-9.8340***	-17.36
REG3	0.5638***	2.68	-4.8670***	-14.06
REG4	-0.7084***	-2.76	-4.9860***	-14.97
ln(HOUSEPRICE)	0.3206	1.39	3.6398***	20.57
ln(INCOME)	0.0292**	2.01	0.4609***	18.00
MILLSP1	-	-	3.2725***	19.58
MILLSP3	-	-	-3.4195***	-20.49
Constant	1.1434**	2.12	-48.5038***	-19.74
Adjusted R^2	0.1151		0.1788	
Sample size	5,503		5,503	

Notes: (1) The coefficients with ** and *** are significantly different from 0 at the 95% and 99% significance levels, respectively.
(2) Variables with ln(.) apply a natural logarithm.

The variable AGE is a good example that shows how the existence of inverse Mills ratios influences the coefficient, as shown in Table 4. The estimated coefficient of AGE (-0.0213) in the saving function without inverse Mills ratios is significantly less than zero which implies that younger households will save more which is against our intuition. However, the estimated coefficient of AGE (0.7043) in the saving function with inverse Mills ratios is significantly larger than zero which means that older heads of the household will save more. The results show that without considering tenure choice, the estimated coefficient could be seriously biased.

The coefficient of MARRIAGE is another example that shows the importance of inverse Mills ratios. The estimated coefficient of MARRIAGE is significant (0.4831) in the function with inverse Mills ratios, but insignificant (0.0361) in

the function without inverse Mills ratios. The estimated coefficients for SCHOOLING, AGRIHOUSE, HSENUMBER, REG1, REG2, REG3, and REG4, all have similar results.

The estimated coefficient of HOUSEPRICE in the function with inverse Mills ratios is 3.6398, which is much larger than that without inverse Mills ratios (0.3206). The result shows that increases in housing price are one of the reasons that explain why the saving rate is so high in China. The most dramatic result is for the coefficient of INCOME. The estimated coefficient for INCOME changes from 0.0292 in the function without inverse Mills ratios to 0.4609 with inverse Mills ratios. Again, the result here shows that without considering tenure choice, the estimated coefficients could be seriously biased.[9]

In the meantime, the coefficient of MILLSP1 (3.2725) is significantly greater than zero which implies that the saving rate of renters will be greater than that without considering tenure choice. This also means that if a rental household is thinking of buying a house in the future, they will increase their saving now (a kind of forced saving). One the other hand, a traditional saving function without considering tenure choice will underestimate the total savings of renters. The coefficient of MILLSP3 (-3.4195) is significantly less than zero which implies that the saving rate of owners without a mortgage is less than those without considering tenure choice. This also means that without considering tenure choice, the conventional saving function will overestimate the saving of owners without a mortgage.

Finally, to test if forced saving exists, we consider mortgage payment as another kind of forced saving as in Tachibanaki (1994) and Lin and Chen (1998). The estimated results are shown in Table 5. In general, the estimated results are quite similar to those in Table 4. Moreover, the estimated coefficients of MILLSP1 (2.2949) and MILLSP3 (-2.7556) have similar signs as before although with smaller figures. The results show that if we consider mortgage payment as a forced saving, then the saving of owners with a mortgage will be relatively higher than before. Moreover, other things being equal, the saving rate of renters is still higher than that of owners with a mortgage, while the saving rate of owners with a mortgage is still higher than that of owners without a mortgage. The results show that the forced saving rates for owners with a mortgage and renters are much higher than that for owners without a mortgage. Again, our findings are consistent with Lin and Chen (1998) and Lin et al. (2000).

[9] Since the saving rate is so high in China, we would expect a high income elasticity of saving. Here, one can see that without considering tenure choice, the estimated coefficient of income will be significantly underestimated. The estimated income elasticity of saving is 0.4609 here, which is slightly less than the 0.67 in Chang (2009) and 1.54 in Wong et al. (2010). However, the definition of saving in this study is different from the conventional definition, so it may be inappropriate to directly compare our result to those in other research work.

Table 5 Regression on Forced Saving
Dependent variable: ln(FSAVINGS)

	Regression without inverse Mills ratios		Regression with inverse Mills ratios	
Independent Variable	Coefficient	z value	Coefficient	z value
PSNNUMBER	-0.0255	-0.52	-0.1117**	-2.32
GENDER	-0.0313	-0.22	0.1117	0.79
AGE	-0.0454***	-6.21	0.7403***	19.35
SCHOOLING	0.2123***	10.27	0.1763***	8.46
MARRIAGE	0.2583	1.09	0.4831**	2.07
AGRIHOUSE	0.3748**	2.24	0.3568**	2.16
HSENUMBER	0.4010***	2.78	0.7375***	5.12
CITY	0.8455***	5.35	0.5425***	3.40
REG1	0.0424	0.17	-15.9489***	-18.55
REG2	0.0960	0.45	-9.8340***	-17.36
REG3	0.0224	0.11	-4.8670***	-14.06
REG4	-1.2997***	-5.18	-4.9860***	-14.97
ln(HOUSEPRICE)	0.2042***	9.03	3.6398***	20.57
ln(INCOME)	0.0319**	2.24	0.4609***	18.00
MILLSP1	-	-	3.2725***	19.58
MILLSP3	-	-	-3.4195***	-20.49
Constant	2.978***	5.63	-48.5038***	-19.74
Adjusted R^2	0.1172		0.1788	
Sample size	5,503		5,503	

Notes: (1) The coefficients with ** and *** are significantly different from 0 at the 95% and 99% significance levels, respectively.
(2) Variables with ln(.) apply a natural logarithm.

5. Conclusion

Since housing expenditure usually accounts for a large portion of household spending, households need to consider how much they have in order to save for future housing spending when they decide on their daily expenditures, including food, clothing, transportation, education, leisure, and so on and so forth. This means that tenure choice, household consumption, and saving are jointly decided. Unfortunately, most of the conventional studies in the extant literature tend to neglect the impact of tenure choice when discussing saving behavior. Without considering the impact of tenure choice, one may obtain a biased estimation result since they are simultaneously decided. To solve this issue, the impact of tenure choice on saving in Chinese households is estimated in this study.

Applying a data set from the CHFS and separating households into three types of tenure choices, namely, renters, owner-occupied with a mortgage, and

owner-occupied without a mortgage, we first estimate the tenure choice behavior of Chinese households. Our estimation results show that the household characteristics including age, schooling, income, housing price, and number of houses owned are all important in deciding on tenure choice.

Furthermore, applying the Heckman two-stage model, we estimate how tenure choice influences saving. Our estimations show two important findings. First, the coefficients of the inverse Mills ratios are significantly different from zero which implies that the two-stage estimation model is appropriate. Secondly, the estimated coefficients for the factors that affect saving behavior under the two-stage model are significantly different from those in the conventional model. The results show that, without considering tenure choice, the conventional estimation of the factors (such as income and house price) that affect saving behavior will be seriously biased.

Nevertheless, there are still some drawbacks in this study. First, owing to data restriction, the saving data applied in this study are total deposits, but not the conventional definition of saving. Therefore, we are unable to directly compare our results with those of other research work. It will be more informative if we could apply true saving data to this study. Secondly, we use a multinomial logit model to capture tenure choice in this study. It would be interesting if the nested logit model is applied since the choices among renters, owners with a mortgage, and owners without a mortgage might not be independent of each other. Finally, it would also be interesting and meaningful if the amount of forced saving of renters and owners with a mortgage in China can be directly estimated.

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