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# Property Tax and Tenure Choice: Implications for China

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This paper examines real property tax as a determinant of tenure choice. The analysis is conducted in two stages. First, parameter estimates for a reduced-form homeownership model are obtained through multivariate logistic regression on data drawn from the U.S. Survey of Income and Program Participation (SIPP). Second, data from the Chinese Household Income Project (CHIP) is used to obtain predicted homeownership for China by using the SIPP-based model. Actual and predicted values of homeownership in China are presented, and the marginal effect of property tax is computed. Overall, we find that tenure choice is significantly influenced by property tax, even after controlling for a wide range of supply and demand considerations. Furthermore, and in the case of China, we show that the negative impact of property tax on homeownership may be mitigated by corresponding ownership incentives (e.g., tax policy). To the best of our knowledge, this is the first paper to explicitly analyze property tax in this regard. Implications based on the empirical analysis are applicable to the evolution of property tax policy in China.

### **Keywords**

Real Property Tax, Tenure Choice, China

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## 1. Introduction

Property tax, especially real property tax, is the most important source of tax revenue for most local governments in the United States. Some developing countries, for example China, do not have a fully developed property tax policy. This includes home registration, title clearance, property appraisal, and tax collection. Instead, most Chinese municipalities heavily rely on land sale or long-term lease to collect revenue as a means to fulfill their public spending obligations. This practice seems to be ripe for change as land sales are influenced by potential busts in home prices and by supply policies. Wang and Wang (2012) provide a comprehensive and lucid account of how the political environment, legal system and culture of China differ from the U.S. and other mature economies of the western world.

Since 2011, two of the largest cities in China, Chongqing and Shanghai, have initiated separate pilot programs to collect property tax. Chongqing collects this tax on so-called “luxury” homes, if the per square meter price is above 9,941 RMB, or \$156 per square foot. The tax rate is 0.5% to 1.2%, based on the “luxury” metric. Shanghai taxes “above-average” living space, which means properties with an area above 60 square meters per person, at a rate of 0.4%-0.6%. All taxes are based on newly purchased homes after the policy goes into effect, and in Shanghai, it is purely based on voluntary declaration.

Not surprisingly, the tax has had little effect on the frenzied real estate markets in the two cities, nor did it collect meaningful tax revenue for the local governments. The year-over-year price has shown only moderate decline in January 2012, only after other measures to control the housing market were put into effect, such as limiting purchases, mortgages, and prices. Chongqing collected merely 90 million RMB (13.6 million US\$), in the first ten months, which is less than 0.2% of its total tax revenue.

It is very likely that China will expand this tax to other cities, and possibly to a much broader category of residential homes. However, there is a trade-off. If the tax rate is too low, there will not be enough tax revenue, and the local governments still face a cash shortfall. If the tax rate is too high, it will put additional pressure on the already nervous housing market, and a housing collapse could severely damage the banking system.

In order to design a sound property tax policy, China should consider the demand elasticity with regard to tax rate.<sup>1</sup> This need provides motivation for the research addressed in this paper. To be specific, we attempt to answer the following two research questions: first, what is the impact of the real property

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<sup>1</sup> Wang, Chan and Xu (2012) examine the price elasticity of supply for housing in China. However, and as stated clearly by the authors, the cost of homeownership in their analysis does not include property tax as “there is no enacted property tax during the sample period”.

tax rate on aggregate housing demand (represented by homeownership)? Second, how might this impact influence homeownership in China? After we know the impact of real property tax rate on housing demand, we will address the following policy question: what might be the characteristics of a sound real property tax policy for an emerging market country, such as China, to avoid housing market turmoil, and promote homeownership and social equality?

The balance of this paper is organized in this way: we first offer a literature review. Next, we describe the data sources and data set construction. The results are presented for empirical analysis based on a regression model for long-term tenure choice (i.e., the unconditional probability of choosing homeownership or rentership). We also apply the previous estimation results to a uniquely-Chinese data set to determine what implications might be noted.<sup>2</sup> In the final section, we discuss our contributions, future research and conclude the paper.

## 2. Literature Review

There has been abundant research literature on the topic of homeownership. However, there has been little, if any, research on the causal relation between property tax and homeownership. The existing research is mainly concentrated on the following aspects: (a) benefits and disadvantages of homeownership, (b) disparities of homeownership among different household groups, (c) factors that affect homeownership, and (d) factors that affect household transition into homeownership. Furthermore, and as discussed by Wang and Wang (2012), China provides a rich laboratory to study issues that are unique to developing economies. All the same, the literature on property markets in China is scarce, albeit nascent.

Both common wisdom and academic research have linked homeownership with happiness, better citizenship, and more community involvement. Rossi and Weber (1996) find that homeowners are generally happier based on a specific metric. Goetz and Sidney (1994) find an “ideology of property” that separates the interests of homeowners from those of lower-income tenants. According to this ideology, owners are better citizens than renters. Rohe and Stegman (1994) and Rohe and Basolo (1997) report that renters who become owners appear to be more satisfied than continuing renters.

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<sup>2</sup> An important caveat in the analysis pertains to the comparison of U.S. and Chinese consumers. Thus we stress that although the cultural habits and income levels are highly different between the U.S. and China, we do not observe drastically discrepant behavior in our analysis for homeownership patterns, with regard to demographic and economic factors. As such, the proposition that homebuyers will behave similarly against property tax, when making their tenure choices, is not unreasonable.

On the contrary, there have been arguments that homeownership is also linked with unemployment, not-so-much-better citizenship, and sometimes unhappiness. Oswald (1997) claims that homeownership is strongly correlated with the unemployment rate among 25 industrial nations. Krueckeberg (1999) debunked the notion that owners are better citizens and claims a bias against renters, and that this deliberate bias which favors owners and harms renters has been prominent in the U.S. for centuries. Wong (2009) studies female owners and renters in an Ohio neighborhood and finds that owners are generally unhappier than their renter counterparts. It seems that so far the evidence is not conclusive whether homeownership brings happiness, encourages good citizenship, or promotes community services.

Another important category of homeownership literature is the disparity among different population groups, especially different racial or ethnic groups. Bostic and Surette (2001) find that the homeownership gap between minority and non-minority households have significantly declined between 1989 and 1998. Coulson (2002) finds the relative price of owning and renting helps to explain regional homeownership disparities across the U.S. Gabriel and Painter (2003) claim that location choices help to explain the tenure choice difference between black and white households in Los Angeles. Gabriel and Rosenthal (2003) find that socioeconomic characteristics help to explain large portions of the homeownership gap between minority and white ethnic groups. At the same time, there is a significant portion of the gap that is unexplained, which might be attributed to credit barriers or other factors. Painter et al. (2003) find that Chinese homeownership is 18% higher than native white households, after controlling for socioeconomic and housing market characteristics. These authors claim that cultural influence might play a significant role in this phenomenon.

There has also been research on the determinants of homeownership changes. Painter and Redfearn (2002) find that interest rates play little direct role in changing homeownership. Chen and Tong (2006) find that affordability is significantly lower than reported by commonly-used housing affordability indexes, and homeownership is strongly correlated with household affordability. Chambers et al. (2007) claim the rapid homeownership rise during 1994-2005 was caused by changes in demographic factors and innovations in the mortgage market that lessened down payment requirements.

Zorn (1989) and Zorn (1993) are among the first to use micro-level data to empirically validate the effect of mortgage qualification requirements on household transition into homeownership. Zorn (1989) demonstrates that down payment and debt-to-income requirements for home buyers adversely impact the ability to become a homeowner. Zorn (1993) shows that these mortgage constraints have different impacts on renters vs. owners. As an aside, and foreshadowing our results, we will show that these conclusions are very consistent with our empirical analysis.

Alm, Buschman, and Sjoquist (2011) and Lutz, Molloy, and Shan (2011) each document that local government tax revenue lags a housing market collapse, and the impact is not as severe as people generally anticipate. This effect is partially due to the counter-cyclicality of property appraisal and partially due to geographic disparity. Lin (2010) finds an assessment bias between different property types in Taiwan, which is most likely caused by the non-linearity between lot size and land-values. Brueckner and Saavedra (2001) discuss the hypothesis that local government might engage in property-tax competition in order to attract residents and local businesses. Polinsky and Rubinfeld (1978) and Oates (1969) address the question of long-run effects of a residual property tax and local public spending on property value.

Although there has been a significant quantity of research conducted on the advantages and disadvantages of homeownership, the disparities among different population groups, and the factors that cause homeownership change, there has been little research on the issues addressed in this paper. Towards that end, we will attempt to address the void in the body of knowledge on the relation between property tax and homeownership. Specifically, we seek to model the real property tax effect on tenure choice, and to understand the (potential) implications for China. We contend that these questions are of critical importance in formulating property tax policy in China, as well as enlightening other housing-related policies.

### **3. Data Description and Empirical Model**

#### **3.1 Data Source Description**

The core data used in this paper are derived from the Survey of Income and Program Participation (SIPP). The SIPP provides a comprehensive picture of the economic, social, and demographic characteristics of representative households in all 50 states and the District of Columbia. The survey design is a continuous series of national panels, with sample size that ranges from approximately 30,000 to 40,000 interviewed households. The duration of each panel ranges from 3 to 4 years. The SIPP collects the source and amount of income, labor force information, program participation and eligibility data, and general demographic characteristics. In this paper, we use the 2004 and 2008 SIPP panels, which describe the characteristics of representative households from the end of 2003 to 2011.

The 2004 panel contains 12 waves, and the 2008 panel contains 9 waves since it is not completed. Each wave contains 4 months, so there are a total of 48 months for the 2004 panel, and 36 months for the 2008 panel of monthly observations on the tenure status, income, wealth, welfare, and other information of each household member. It is important to note that each panel is independently surveyed, so the households do not necessarily overlap over different panel periods.

We are most interested in the following demographic and microeconomic data fields from the SIPP:

- Tenure choice: whether a household rents or owns the property, for each observation month;
- Household type: married couple, single mother, single father, single male, single female, or unrelated household of group housing;
- Household member age;
- Household member gender;
- Household member race;
- Household member count;
- Family children count;
- Total household income; and
- Flag whether household receives cash or non-cash benefit.

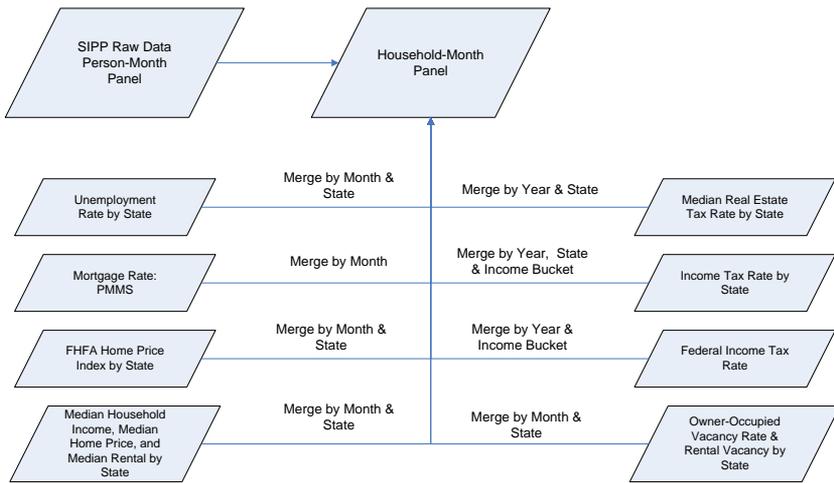
Besides the SIPP data, we employ other data sources, which mainly contain macroeconomic variables. These data sources include the following:

- Federal Housing Finance Agency: state-level home price indexes since 1991;
- Moody's Economy.com: the following data are downloaded from this web site:
  - state-level median household income since 1979,
  - state-level median home price data since 1990, and
  - state-level median rental cost since 2001;
- TaxFoundation.org: the following tax information is acquired from this web site:
  - federal income tax rate by year, filing status, and income bucket;
  - state income tax rate by year, filing status, and income bucket;
  - local income tax rate by year and filing status, if applicable; and
  - state-level median real property tax rate, which is calculated as real property tax paid divided by median household income. Since real property tax is generally determined at the municipality level, this approach is a first-best approximation.

The China data are taken from the Chinese Household Income Project (CHIP, 2002). The CHIP is a survey intended to reflect the distribution of personal income and related economic factors in both rural and urban areas of the People's Republic of China. Data were collected through a series of questionnaire-based interviews conducted in rural and urban areas at the end of 2002.

### **3.2 Data Set Construction and Summary Statistics**

Figure 1 illustrates the steps taken to merge the macroeconomic variables into the SIPP household panel data. Table 1 defines the variables that comprise the household-month panel data set.

**Figure 1 Data Set Construction**

The next step in constructing the data set requires matching the SIPP-derived variables to comparable variables in the CHIP data. Fortunately, there is exact mapping between most SIPP and CHIP variables. Where the mapping is not exact, we make qualifying assumptions and discuss those as follows with the summary statistics.

### 3.3 Summary Statistics

Table 3 reports the summary statistics for the SIPP-and CHIP-derived data. First, we observe that there are over 2 million observations for the U.S. based data and nearly 7 thousand observations for the China data. The homeownership rate in the U.S. is 69.2% compared to 78.2% in China. We report a mean income tax rate of zero for China since there was little enforcement of personal income tax and payroll tax deduction in 2002. Likewise, we set the property tax rate to zero as this did not exist.

For the home price data, we use the self-estimated home price and calculate the median home price for each city to determine the median home price to median household income ratio. The reported rental cost data is highly irregular, so we assumed that the rental and mortgage cost for the same home is the same.

**Table 1 Variable Descriptions for Standard Panel**

<b>Variable Name</b>	<b>Variable Description</b>
owner	1=owner, 0=otherwise
PptyTax_Income_Ratio	Property Tax Ratio to Income
IncomeTaxRate	Total Income Tax Rate of the household
male	1=household head is male, 0=otherwise
minority	1=household head is Asian or Black, 0=otherwise
highschool	1=household head education is below or equal to high school, 0=otherwise
college	1=household head education is below or equal to college, 0=otherwise
master_up	1=household head education is above or equal to master, 0=otherwise
education_unk	1=household head education is unknown, 0=otherwise
family_couple	1=household is family with married couple, 0=otherwise
family_male	1=household is family with single dad, 0=otherwise
family_female	1=household is family with single mom, 0=otherwise
nofamily_male	1=household is single male, 0=otherwise
nofamily_female	1=household is single female, 0=otherwise
group_quarter	1=household is group quarter, 0=otherwise
ageLE30	1=household head age is less than or equal to 30, 0=otherwise
ageLE40	1=household head age is 31-40, 0=otherwise
ageLE50	1=household head age is 41-50, 0=otherwise
ageLE60	1=household head age is 51-60, 0=otherwise
ageLE70	1=household head age is 61-70, 0=otherwise
ageLE80	1=household head age is 71-80, 0=otherwise
ageLE90	1=household head age is 81-90, 0=otherwise
ppLE3	1=Family has 0-3 kids, 0=otherwise
ppLE6	1=Family has 4-6 kids, 0=otherwise
ppLE10	1=Family has 7-10 kids, 0=otherwise
ppLE15	1=Family has 11-15 kids, 0=otherwise
ppLE25	1=Family has 16-25 kids, 0=otherwise
hh_aid_all	1=household receives cash or non-cash aid, 0=otherwise
metro	1=household lives in metro area, 0=otherwise
total_income	Monthly total household income, in thousands
med_hp_income_ratio	Median home price to median household income ratio
rent_pmt_ratio	Median rent to IO pmt ratio

**Table 2 Data Summary for SIPP Panel and CHIP Survey Data**

Variable	SIPP Panel Data (2003-2011)			CHIP Survey Data (2002)		
	N	Mean	Std Dev	N	Mean	Std Dev
owner	2722978	0.692	0.462	6835	0.782	0.413
PptyTax Income Ratio <sup>1</sup>	2718087	0.030	0.014	6835	0	0
IncomeTaxRate <sup>1</sup>	2621511	0.247	0.075	6835	0	0
male	2722978	0.435	0.496	6835	0.672	0.469
minority	2722978	0.158	0.364	6835	0.039	0.193
highschool	2722978	0.370	0.483	6835	0.731	0.443
master_up	2722978	0.098	0.297	6835	0.005	0.069
education unk	2722978	0.000	0.011	6835	0.001	0.034
family male	2722978	0.039	0.195	6835	0.011	0.102
family female	2722978	0.133	0.340	6835	0.000	0.000
nofamily male	2722978	0.135	0.341	6835	0.002	0.045
nofamily female	2722978	0.177	0.382	6835	0.000	0.000
group_quarter	2722978	0.003	0.056	6835	0.008	0.087
ageLE40	2722978	0.177	0.382	6835	0.261	0.439
ageLE50	2722978	0.209	0.406	6835	0.346	0.476
ageLE60	2722978	0.194	0.395	6835	0.215	0.411
ageLE70	2722978	0.142	0.349	6835	0.108	0.310
ageLE80	2722978	0.097	0.295	6835	0.037	0.188
ageLE90	2722978	0.062	0.241	6835	0.002	0.044
ppLE6	2722978	0.059	0.236	6835	0.019	0.137
ppLE10	2722978	0.007	0.083	6835	0.000	0.000
ppLE15	2722978	0.001	0.022	6835	0.000	0.000
ppLE25	2722978	0.000	0.005	6835	0.000	0.000
hh_aid_all <sup>2</sup>	2722978	0.269	0.444	6835	0	0
metro <sup>3</sup>	2722978	0.754	0.431	6835	1	0
total income	2722978	4.795	4.331	6835	1.980	1.297
med_hp income ratio	2718087	3.935	1.463	6835	3.062	1.261
rent_pmt ratio <sup>4</sup>	2718087	0.981	0.346	6835	1	0

**Notes:** 1. These values are set to zero as a tax system was not developed during the CHIP data period.

2. Since the social safety network was almost non-existent in China in 2002 and there is no reliable data for government aid, we assume no households receive cash or non-cash aid.

3. We only use the urban households in the CHIP survey.

4. Since the reported rent data is highly irregular, we assume the rent and mortgage payment ratio to be constant.

#### 4. Empirical Model Construction

This section presents a reduced form model for the estimation of tenure choice. The objective is to obtain parameter estimates from a generalized logit model for the purpose of predicting tenure choice in alternative economies. The functional form is as follows:

$$\text{Logit}(\Pr(H(i,t)=1)) = \alpha + \beta_1 X(i,t) + \beta_2 U(i,t) + \beta_3 R(i,t) + \beta_4 S_o(t) + \beta_5 S_R(t) \quad (1)$$

where  $H(i,t)$  is the homeowner status of household unit  $i$  at time  $t$ , and takes the value of 1 or 0;  $X(i,t)$  is the demographic variable vector for household unit  $i$  at time  $t$ ;  $U(i,t)$  is the variable vector of home-owning user cost for household unit  $i$  at time  $t$ ;  $R(i,t)$  is the variable vector of home-renting user cost for household unit  $i$  at time  $t$ ;  $S_o(t)$  and  $S_R(t)$  are the supply of owner-occupied housing and rental housing, approximated by owner vacancy and rental vacancy, and  $Pr(\cdot)$  is the probability function.  $\text{Logit}(\cdot)$  is the logit function.

This model is analogous to the tenure choice model of Iwarere and Williams (1991). The current specification follows Chang and Chen (2011), which states that households with different family status and age groups will choose differently with regard to tenure choice. Family choices are also affected by numerous economic constraints, e.g. income, income tax rate, property tax rate, rental cost, etc. Table 3 presents the expected relations between tenure choice and the key explanatory variables, plus the control variables.

**Table 3** Expected Relations

Variable	Expected Sign & Note
owner	Dependent Variable
PptyTax_Income_Ratio	Negative, higher property tax rate will reduce the benefit of homeownership;
IncomeTaxRate	Positive, higher tax bucket will induce more incentive to utilize the tax incentives for homeownership;
male	Negative, since female household head is likely to have higher education and salary;
minority	Negative, since there is generally a minority homeownership gap;
highschool	Negative, lower education generally lead to lower life achievement;
college	Used as base case;
master_up	Positive;
education_unk	Indeterminate;
family_couple	Used as base case;
family_male	Negative, since married couple has more incentive and financial strength;
family_female	Negative, since married couple has more incentive and financial strength;

(Continued...)

*(Table 3 Continued)*

<b>Variable</b>	<b>Expected Sign &amp; Note</b>
nofamily_male	Negative, since married couple has more incentive and financial strength;
nofamily_female	Negative, since married couple has more incentive and financial strength;
group_quarters	Negative, since married couple has more incentive and financial strength;
ageLE30	Used as base case;
ageLE40	Positive, aging should increase incentive and financial strength;
ageLE50	Positive, aging should increase incentive and financial strength;
ageLE60	Positive, aging should increase incentive and financial strength;
ageLE70	Positive, aging should increase incentive and financial strength;
ageLE80	Indeterminate, additional aging might reduce the incentive to own a home;
ageLE90	Indeterminate, additional aging might reduce the incentive to own a home;
ppLE3	Used as base case;
ppLE6	Positive, more children means more incentive;
ppLE10	Indeterminate, additional children might reduce financial incentive;
ppLE15	Indeterminate, additional children might reduce financial incentive;
ppLE25	Indeterminate, additional children might reduce financial incentive;
hh_aid_all	Negative, it is an indicator of financial weakness;
metro	Negative, people are more mobile and homes are more expensive;
total_income	Positive, increases affordability;
total_taxRate	Positive, higher tax bucket will induce more incentive to take the tax advantage of homeownership;
rent_pmt_ratio	Positive, a higher rent to payment ratio means it is preferable to own than to rent.

## 5. Empirical Analysis and Results

The empirical analysis is based on the model described above. The estimation is presented in this section, and implications are included here and in the following sections. The first stage of the analysis (i.e., parameter estimation), is conducted for the full U.S. sample and a sample based on metropolitan-area households. This approach offers two important contributions. First, we obtain external validity for the metro-only sample by comparing the results for

the full sample. Second, the metro-only U.S. sample is more directly comparable to the China CHIP data. This section focuses on the metro-only results. The full results are presented in the Appendix for easy reference.

## 5.1 Model Estimation

Table 4 reports the logistic regression results for Equation (1) and the metro-only U.S. data. To a large extent, the results validate the hypothesis that demographic attributes are significant determinants, e.g. race, education, household type, age of the household head, number of people in the family, as well as microeconomic factors (income level, whether receiving aid) and macroeconomic factors (total income tax rate, property tax rate, median home price to median income ratio).

**Table 4 Homeownership Results**

Parameter		Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1.123	0.016	4862.82	<.0001
PptyTax_Income_Ratio		-12.415	0.134	8614.85	<.0001
IncomeTaxRate		1.310	0.041	1006.70	<.0001
male		-0.156	0.005	857.04	<.0001
minority		-0.565	0.005	15617.01	<.0001
highschool		-0.267	0.004	4339.06	<.0001
master_up		0.013	0.007	3.46	0.063
education_unk		1.233	0.140	77.38	<.0001
family_male		-0.725	0.009	6043.76	<.0001
family_female		-0.891	0.006	19606.20	<.0001
nofamily_male		-1.464	0.006	55272.72	<.0001
nofamily_female		-1.419	0.006	51149.46	<.0001
group_quarters		-2.562	0.032	6474.90	<.0001
ageLE40		0.814	0.006	17162.13	<.0001
ageLE50		1.353	0.006	47621.19	<.0001
ageLE60		1.740	0.007	70923.14	<.0001
ageLE70		2.216	0.007	89356.89	<.0001
ageLE80		2.487	0.008	88644.97	<.0001
ageLE90		2.284	0.009	63751.10	<.0001
ppLE6		0.222	0.008	808.58	<.0001
ppLE10		0.085	0.021	17.01	<.0001
ppLE15		-0.011	0.078	0.02	0.8859
ppLE25		-0.073	0.383	0.04	0.8495
hh_aid_all		-1.077	0.004	58957.35	<.0001
total_income		0.124	0.001	15242.48	<.0001
med_hp_income_ratio		-0.170	0.002	10593.88	<.0001
rent_pmt_ratio		-0.218	0.007	868.97	<.0001
<b>R-Square (%)</b>	27.4	<b>Max-rescaled R-Square (%)</b>		38.3	

The sign and magnitude of the coefficients are consistent with prior work. For example, Chen (2009) finds that single fathers are more likely to own homes than single mothers, but a single female is more likely to own a home than a single male. These results are relative to the base case of “family\_couple” as shown in Tables 1 and 2. We also find the likelihood of owning a home sharply increases from age 30 to 50, gradually increases to age 80, and declines after 80. This pattern of ownership fits nicely with the life-cycle theory of housing demand. In addition, we find that more children lead to higher homeownership, but many children do not have a significant impact. Higher education is associated with increased homeownership, after controlling for income, which may be interpreted by some as better education will lead to higher lifetime achievement.

As for microeconomic variables, such as income, and income and property tax rates, we find strong evidence in favor of the hypothesis. Higher income increases homeownership. Higher total income tax rate seems to create an incentive to buy housing which may be explained by the tax benefit. Importantly, this result holds even after controlling for income. In contrast, a higher real property tax rate negatively impacts homeownership. This evidence is new and fundamentally important to our investigation.

The macro variable, median home price to median household income ratio (*med\_hp\_income\_ratio*), which is an affordability index, clearly states that relatively higher home prices depress homeownership. The only unintuitive coefficient is rent to payment ratio, which measures the ratio of the median rent for each state to interest only payment for a 100% LTV FRM30 mortgage of a median home. One might expect a higher rent to payment ratio would increase homeownership, as this means owning a home is cheaper than renting a home. One possible explanation is that low rent areas are also affordable ownership areas, so people still choose to own because of other homeownership benefits.

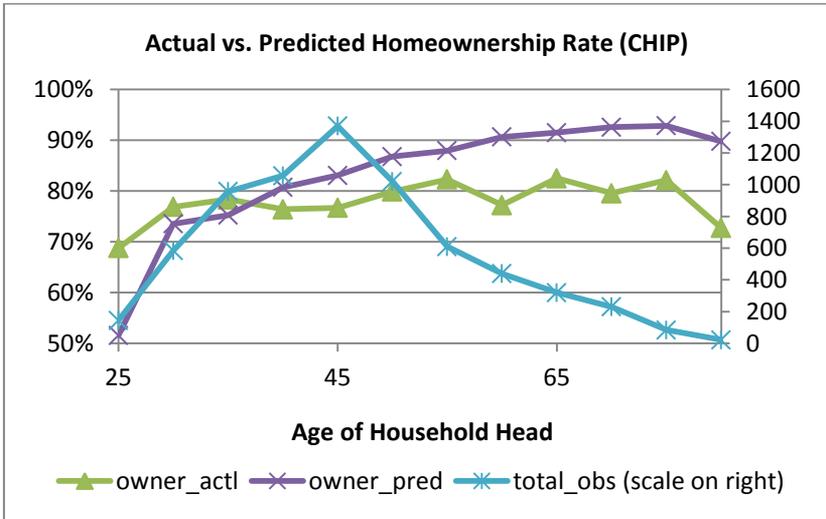
## **5.2 Estimation based on China Data**

The next stage of our analysis makes use of the parameter estimates obtained in the proceeding analysis. Specifically, we calculate predicted homeownership with the SIPP-derived parameter estimates and the CHIP data. Figures 2 and 3 show that the predicted values compare favorably to the actual China homeownership rates across two cases: (a) head of household age and (b) total household annual income in RMB. As expected, the difference between actual and predicted homeownership is more volatile in the case where there are fewer observations.

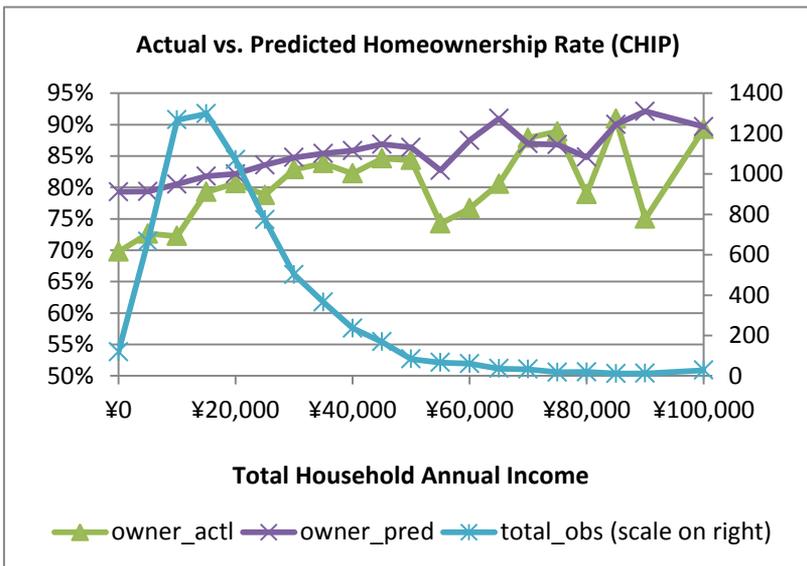
Analyzing the predicted homeownership for China based on U.S. tenure decisions contributes to an understanding of whether U.S. and Chinese consumer behavior can be compared, at least with respect to tenure choice. Given the fact that we have carefully controlled for demographic and

economics factors available for both economies, we proceed with the analysis, noting the aforementioned caveat and a degree of confidence that the comparison is tenable.

**Figure 2 Homeownership Model Fit on CHIP Survey Data (Age Dimension)**



**Figure 3 Homeownership Model Fit on CHIP Survey Data (Income Dimension)**



Thus having established this confidence in the applicability of the U.S. based model applied to data from China, we examine the attribution of explanatory variables to the China tenure choice decision. Table 5 reports the parameter estimates from Table 4. Also included are the mean values of the determinants. At the bottom of the mean columns are the predicted values of homeownership based on the reduced form model and two country-specific data sets. We also show the actual homeownership rate for each country and the deviation between predicted and actual values.

The main focus of Table 5, and the associated analysis, is to report the change in predicted homeownership for a simulated change in China's policy. To do this, we take the predicted homeownership rate based on the CHIP data means and replace individual attributes (i.e., variables) with their SIPP counterpart. In other words, we re-exponentiate to obtain predicted probabilities for China with individual U.S. values to simulate the impact on homeownership. In addition, Table 5 is sorted by attribution impact from most negative to most positive. The far right column reports the marginal impact on homeownership rates based on the simulated policy change. The objective is to simulate housing tenure based on the implementation of a property tax system in China.

**Table 5 Homeownership Prediction for Average SIPP and CHIP Household**

Variable	Parameter Estimate	SIPP Mean	CHIP Mean	Predicted Change (sort)
PptyTax_Income_Ratio	-12.415	0.030	0.000	-5.69%
hh_aid_all	-1.077	0.269	0.000	-4.25%
nofamily_female	-1.419	0.177	0.000	-3.63%
nofamily_male	-1.464	0.135	0.002	-2.76%
ageLE50	1.353	0.209	0.346	-2.64%
med_hp_income_ratio	-0.170	3.935	3.062	-2.07%
family_female	-0.891	0.133	0.000	-1.64%
ageLE40	0.814	0.177	0.261	-0.93%
minority	-0.565	0.158	0.039	-0.91%
ageLE60	1.740	0.194	0.215	-0.51%
family_male	-0.725	0.039	0.011	-0.28%
education_unk	1.233	0.000	0.001	-0.02%
ppLE15	-0.011	0.001	0.000	0.00%
ppLE25	-0.073	0.000	0.000	0.00%
metro	0.000	0.754	1.000	0.00%
Intercept	1.123	1.000	1.000	0.00%
ppLE10	0.085	0.007	0.000	0.01%
master_up	0.013	0.098	0.005	0.02%
rent_pmt_ratio	-0.218	0.981	1.000	0.06%

*(Continued...)*

*(Table 3 Continued)*

Variable	Parameter Estimate	SIPP Mean	CHIP Mean	Predicted Change (sort)
ppLE6	0.222	0.059	0.019	0.12%
group quarters	-2.562	0.003	0.008	0.15%
male	-0.156	0.435	0.672	0.49%
ageLE70	2.216	0.142	0.108	0.98%
highschool	-0.267	0.370	0.731	1.24%
ageLE90	2.284	0.062	0.002	1.73%
ageLE80	2.487	0.097	0.037	1.88%
IncomeTaxRate	1.310	0.247	0.000	3.84%
total income	0.124	4.795	1.980	4.11%
Predicted Ownership		75.15%	84.21%	
Actual Ownership		69.21%	78.17%	
Deviation		5.94%	6.04%	

For instance, the predicted homeownership rate for China drops by 5.69% when the CHIP Property Tax to Income Ratio (i.e., *PptyTax\_Income\_Ratio*) is replaced by the SIPP mean. In contrast to the impact of real property taxes on homeownership rate in China, we point out the effect of total income and the income tax rate. Both variables are at the bottom of the attribution-sorted table. Specifically, as China considers the implementation of property and income tax systems with various ownership incentives, there exists a potentially offsetting impact on the homeownership rate. Our analysis indicates a 3.84% increase in the homeownership rate as the tax rate in China moves toward the U.S. mean.

One limitation of this analysis is that we only have a snapshot of the 2002 CHIP survey data. Nonetheless, our analysis is illustrative of the impact that policy changes can have on tenure choice and the potential benefits that policy makers may capitalize on by implementing offsetting changes.

## 6. Contributions and Future Research

This paper takes a particularly innovative approach in examining the impact of real property tax on tenure choice. To the best of our knowledge, this is the first study of its kind. Furthermore, the analysis is extended in such a way that implications may be drawn with regard to the development or evolution of property tax policy in China. In large part, our research addresses the call by Wang and Wang (2012) to address the gap in real estate research applicable to the developing economy of China. By examining the implications of a real property tax system in China, our work also complements the supply elasticity research of Wang, Chan and Xu (2012).

Our first finding shows that property taxes, relative to income, adversely impact the tenure choice decision. In this case, we find that homeownership is negatively related to property tax rates. Applying the homeownership rate model to the CHIP 2002 survey data reveals relatively good model prediction, which suggests the model estimated on U.S. economic drivers can be used to predict the behavior of Chinese households, after adjusting for country-specific demographic effects. The reduced-form model predicts a lower homeownership rate if a real property tax is introduced. However, the effect can be mitigated with some countermeasures, such as those found through income tax-based incentives. Based on our findings, one might predict that there will not be significant downward pressure on the homeownership rate and annual housing demand in China, if moderate property tax is introduced. If the government also introduces personal income tax incentives, the effect of property tax on user cost can be much lower.

Policy analysts and government officials in the People's Republic of China may find these results illustrative of the cost-benefit tradeoffs associated with real property taxes.

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## Appendix 1 Full U.S. Sample Results

**Table A1 Homeownership Results**

Parameter		Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept		1.294	0.014	8249.68	<.0001
PptyTax_Income_Ratio		-12.734	0.121	11016.45	<.0001
IncomeTaxRate		1.408	0.036	1471.03	<.0001
male		-0.145	0.004	968.60	<.0001
minority		-0.546	0.004	17289.84	<.0001
highschool		-0.222	0.003	3985.37	<.0001
master_up		-0.016	0.006	6.55	0.0105
education_unk		1.157	0.122	89.53	<.0001
family_male		-0.694	0.008	7255.85	<.0001
family_female		-0.903	0.005	26394.43	<.0001
nofamily_male		-1.458	0.005	71612.15	<.0001
nofamily_female		-1.424	0.005	67711.12	<.0001
group_quarters		-2.676	0.028	8711.33	<.0001
ageLE40		0.821	0.005	22611.20	<.0001
ageLE50		1.338	0.005	60369.44	<.0001
ageLE60		1.731	0.005	91421.21	<.0001
ageLE70		2.193	0.006	115581.86	<.0001
ageLE80		2.412	0.007	112319.36	<.0001
ageLE90		2.222	0.007	81409.93	<.0001
ppLE6		0.178	0.006	683.35	<.0001
ppLE10		0.078	0.017	18.91	<.0001
ppLE15		0.088	0.065	1.81	0.1786
ppLE25		0.857	0.319	7.20	0.0073
hh_aid_all		-1.066	0.004	78132.67	<.0001
metro		-0.166	0.003	1843.45	<.0001
total_income		0.120	0.001	17840.16	<.0001
med_hp_income_ratio		-0.172	0.002	13028.23	<.0001
rent_pmt_ratio		-0.217	0.006	1121.45	<.0001
<b>R-Square (%)</b>	26.4	<b>Max-rescaled R-Square (%)</b>		37.2	

**Table A2 Homeownership Prediction for Average SIPP and CHIP Household**

<b>Variable</b>	<b>Parameter Estimate</b>	<b>SIPP Mean</b>	<b>CHIP Mean</b>	<b>Predicted Change (sort)</b>
PptyTax_Income_Ratio	-12.734	0.03043	0.00000	-5.79%
hh_aid_all	-1.066	0.26917	0.00000	-4.15%
nofamily_female	-1.424	0.17691	0.00000	-3.60%
nofamily_male	-1.458	0.13460	0.00205	-2.71%
ageLE50	1.338	0.20851	0.34631	-2.58%
med_hp_income_ratio	-0.173	3.93489	3.06245	-2.08%
family_female	-0.903	0.13341	0.00000	-1.65%
ageLE40	0.821	0.17745	0.26101	-0.92%
minority	-0.546	0.15757	0.03862	-0.87%
ageLE60	1.731	0.19377	0.21536	-0.50%
family_male	-0.694	0.03947	0.01053	-0.27%
master_up	-0.016	0.09783	0.00483	-0.02%
education_unk	1.157	0.00012	0.00117	-0.02%
Intercept	1.294	1.00000	1.00000	0.00%
ppLE25	0.857	0.00002	0.00000	0.00%
ppLE15	0.088	0.00050	0.00000	0.00%
ppLE10	0.078	0.00699	0.00000	0.01%
rent_pmt_ratio	-0.217	0.98088	1.00000	0.05%
ppLE6	0.178	0.05920	0.01902	0.09%
group_quarters	-2.676	0.00316	0.00761	0.16%
male	-0.145	0.43538	0.67213	0.45%
metro	-0.166	0.75390	1.00000	0.53%
ageLE70	2.193	0.14199	0.10768	0.96%
highschool	-0.222	0.36982	0.73138	1.02%
ageLE90	2.222	0.06177	0.00190	1.67%
ageLE80	2.412	0.09664	0.03672	1.80%
total_income	0.120	4.79487	1.97977	3.95%
IncomeTaxRate	1.408	0.24662	0.00000	4.04%
Predicted Ownership		75.79%	84.45%	
Actual Ownership		69.21%	78.17%	
Deviation		6.58%	6.28%	