

Why Is Taiwan's Homeownership Rate So High?

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Abstract

With an annual growth rate of 0.62 per cent since 1980, Taiwan's homeownership rate reached 88 per cent in 2007. This study explores possible causes of Taiwan's high homeownership rates. The institutional and economic context for tenure choice in Taiwan is reviewed, paying particular attention to the taxation and financing of owner-occupied housing, house prices relative to rents, housing subsidies and housing demand. A model of tenure choice is estimated and then used to simulate policy and other changes. It is concluded that Taiwan's high rate of homeownership is due primarily to the low user cost of owner-occupied housing, which is due in part to house price inflation. Government mortgage subsidy policies designed to support ownership appear to have little effect.

1. Introduction

Taiwan's homeownership rates have increased at an annual compound rate of 0.62 per cent since 1980 and reached an historical high level of 88 per cent in 2007 (Figure 1). This ownership rate is much higher than that of most of the countries in the world (Table 1). Of the countries listed in Table 1, only Singapore and several former Soviet or eastern bloc countries have higher rates than Taiwan. Singapore's government has heavily promoted and supported homeownership since the 1960s and the former

Soviet and eastern bloc countries have turned over public rental housing to tenants. In spite of its high ownership rate, Taiwan's government surprisingly still provided a total of NT\$ 2.2 trillion in mortgage interest subsidies to encourage homeownership between 2000 and 2009.¹

Some studies have concluded that homeownership can increase households' attachment to their properties and communities, which tends to have a stabilising effect on society (see, for example, DiPasquale and

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Figure 1. Homeownership rates, 1980–2008.

Source: Income and Expenditure Survey of Taiwan, 1980–2008.

Glaeser, 1999). Homeownership can also have positive impacts on behaviour, especially during childhood (Green and White, 1997, Haurin *et al.*, 2002). Dietz and Haurin (2003) provide a thorough review of the literature on the impacts of homeownership. For Taiwan, Lien *et al.* (2008) conclude that ownership, floor space and residential stability are positively related to enrolment in high school for teenagers and college enrolment for young adults. However, Barker and Miller (2009) have begun to question some of the previous research and received wisdom on the benefits of ownership. Homeownership may have costs with respect to social resource allocation, economic development and housing market operation. Excessive emphasis on homeownership may have negative impacts on labour mobility and may cause the rental sector to become relatively dysfunctional. Public policy skewed towards homeownership may have helped to create problems in the US in recent

years, including the creation of unsustainable mortgage products and extension of loans to non-creditworthy borrowers, contributing to the sub-prime meltdown and eventually the global financial crisis.

The literature on housing tenure in Taiwan is fairly limited. Hsueh and Chen (1999) used probit models and the Housing Status Survey for 1982 and 1993 to investigate homeownership rate changes in Taiwan. They found that the ratio of prices to rents increased, which would have reduced the homeownership rate if all else were equal. However, increases in expected house prices encouraged a rise in ownership rates. In general, the price effect was the main influence on the ownership rate, increasing the rate by about 8.8 percentage points between 1982 and 1993.

In addition to high expected house price inflation, several other explanations have been advanced to explain Taiwan's high ownership rate. First, income and property

Table 1. Ownership rates for selected countries

Country	Percentage	Country	Percentage
Singapore	92.0	Cyprus	68.0
Romania	91.6	New Zealand	66.9
Hungary	90.9	United States	66.2
Lithuania	84.9	Luxembourg	66.1
Taiwan	82.5	Finland	63.5
Spain	82.1	Belgium	63.1
Slovenia	81.5	Japan	60.3
Ireland	76.9	Latvia	59.6
Norway	76.7	Poland	58.9
Portugal	74.8	France	54.7
Slovakia	73.6	Hong Kong	52.8
Estonia	72.2	Netherlands	50.4
Greece	71.7	Austria	48.7
Italy	71.2	Liechtenstein	48.1
Australia	70.2	Czech Republic	47.1
Canada	68.4	Germany	42.0
United Kingdom	68.0	Switzerland	33.6

Note: According to the 2008 Income and Expenditure Survey of Taiwan, the ownership rate had grown to 88.1 per cent by that year.

Sources: Australian Bureau of Statistics (<http://www.abs.gov.au>); European Commission (<http://epp.eurostat.ec.europa.eu>); Hong Kong Census and Statistics Department (<http://www.censtatd.gov.hk>); Statistics Canada (<http://www.statcan.gc.ca>); Statistics New Zealand (<http://www.stats.govt.nz>); Statistics Singapore (<http://www.singstat.gov.sg>); and US Census Bureau (<http://www.census.gov>). Data are from the most recent census reported (2006 for Australia, Canada, Hong Kong and New Zealand; 2000 for Singapore, Taiwan and the US; and the most recent data as of 2001 for the European countries).

taxation of owner-occupied housing appear to be relatively light, with deductibility of some mortgage interest, preferential tax treatment of capital gains, no taxation of imputed rents and very low property tax rates. Secondly, government-subsidised interest rates may encourage households to buy rather than to rent. Thirdly, the housing 'pre-sale' system is said to reduce the downpayment required to buy a house. Finally, the quality of rental housing is low and protections for tenants are minimal, forcing households who seek good living environments to buy.

The aim of this paper is to explore possible causes of Taiwan's high homeownership rates. We accomplish this in part by specifying and estimating a model of tenure choice and then using that model to simulate the effects

of changes in taxes and subsidies, mortgage underwriting criteria, prices relative to rents and inflation expectations. We pay particular attention to measuring the user cost of owner-occupied housing and mortgage borrowing constraints so that the effects of these changes can be estimated.

The rest of the paper is structured as follows. In the second section, we review the institutional and economic context for tenure choice in Taiwan, focusing on: taxation of owner-occupied housing, financing of owner-occupied housing, subsidisation and taxation of rental housing, house prices and rents, and housing demand. Then we specify a model of tenure choice in the third section. In the fourth section, we discuss the household survey and other data and give more details about how constructed variables are calculated. In

the fifth section, we present the tenure choice estimates and various simulations of policy and other changes. We offer some conclusions and policy recommendations in the final section of the paper.

2. Institutional and Economic Context

2.1 Taxation of Owner-occupied Housing

During the 1970s, the Taiwan government established 'every household should have its own house' as the most important goal for housing policy. The government has actively promoted homeownership and allocated about 90 per cent of its housing subsidies to encourage young and lower- or middle-income households to buy rather than rent by, among other things, providing preferential mortgage interest rates to some buyers and reduced property tax rates.

Homeowners are required to pay land value and building taxes. However, the nominal land value tax rate is only 0.2 per cent for owner-occupied housing, which is just one-fifth of the rate normally applied to other land uses. Furthermore, the nominal building tax rate for residential uses is about 1.2 per cent, with some small variations across cities. According to Peng *et al.* (2007), the effective real estate tax rate for owner-occupied houses is only about 0.11 per cent on average, taking into account both land and building taxes.

Besides the preferential property tax treatment, some mortgage interest is deductible for owner-occupied housing. Owners can deduct up to NT\$ 300 000 (or about US\$ 9500) each year per household from gross taxable income. However, this deduction could be misleading as an explanation of tenure choice because it is tied to a deduction of up to NT\$ 270 000 for savings and investment that is available to all taxpayers, whether owners or renters. The deduction for savings and investment must be taken first and it reduces,

dollar for dollar, the available deduction for mortgage interest. Consequently, the portion of this pair of deductions that is available only to homeowners is equal to NT\$ 30 000, which is equivalent to about US\$ 950. Given the low marginal income tax rates applicable to most households in Taiwan, this is worth very little in practical or economic terms. Consequently, we conclude that mortgage interest is effectively not deductible and rule out the mortgage interest deduction as a potential explanation for Taiwan's high ownership rate.

Homeowners, when they sell their houses, are required to pay a tax on the appreciation of assessed land value during their holding periods. The nominal land value increment tax rates for general land were until recently 40, 50 or 60 per cent, depending on the ratio of the assessed value at the time of sale to the assessed value at the time of purchase.² In contrast, the nominal land increment tax rate for owner-occupied housing is only 10 per cent. The effective tax rates are actually lower because land value assessments tend to be only a fraction of market value (Tsai and Lin, 1999).

2.2 Financing Owner-occupied Housing

The standard residential mortgage in Taiwan is a 20-year adjustable rate mortgage. Mortgage payments plus related housing costs initially cannot exceed 33 per cent of household income and lenders require a minimum downpayment of at least 20 per cent (sometimes as much as 50 per cent) plus closing costs of around 2 per cent. In some cases, lenders have offered interest-only mortgages for the first several years. Nevertheless, borrowers in Taiwan make substantial prepayments, typically paying off mortgage loans about twice as fast as required (Liu and Chang, 2001).

Compared with the large downpayment required to buy existing housing, buyers of new housing typically pay much less when entering into a contract to buy under the

housing pre-sale system. They then pay the remaining downpayment by instalment during the construction period (2 to 3 years). Most households, especially young households, need quite a long time to accumulate enough money to pay the downpayment if they do not receive any financial support from their parents. However, the pre-sale system does not really change the downpayment constraint except to require that the downpayment be paid prior to closing.

There are two kinds of mortgage interest subsidy system in Taiwan. One is a routine subsidy that is provided by the Construction and Planning Agency of the Ministry of the Interior, while the other is a special project subsidy provided by the Central Bank. Prior to 2007, there were 10 different types of routine subsidy defined in terms of the borrowers' characteristics. These included, for example, workers, civil servants and military service members. The mortgage interest, maximum loan amount and borrowing requirements differed across these groups. These were integrated into a single programme in 2007. On average, the subsidised mortgage interest rate has been about 0.5 per cent lower than the market rate. The maximum mortgage amount for each household has been in the NT\$ 2 to 2.2 million range.

Besides the routine mortgage subsidy, the Central Bank has provided preferential interest mortgages to stimulate the real estate market or to avoid financial crisis. These have been offered 10 times since 2000, for a total of NT\$ 2.2 trillion. Except for the quotas, there are no restrictions on who qualifies for the loans. It is difficult to compare the preferential and market interest rates directly as the preferential rate is based on the two-year fixed savings rate of the post office, plus a fixed margin (ranging from 0.125 per cent to 0.85 per cent) and the market rate is an index plus a margin that differs across borrowers. On average, however, the preferential rate is about 0.45 points below the market rate. The

maximum mortgage amount per household is NT\$ 3.5 million in Taipei City and NT\$ 3 million elsewhere.

2.3 Taxation and Subsidisation of Rental Housing

The goal of housing policy in Taiwan has changed gradually over the past several decades to 'every household should live in a suitable house' (Executive Yuan, 2005). This has translated into greater subsidies for renters. Since 2001, the Taiwan government has allowed an income tax deduction for renters. The maximum rent deduction is NT\$ 120 000 for each household. Part of the motivation for this policy was apparently to encourage landlords to report rental income; there is some anecdotal evidence to suggest that some landlords are still trying to avoid paying tax on rental income by offering tenants discounted rents in exchange for not claiming the deduction. We assume that, if that is the case, the discounts are equal to the value of the deduction.

The government also initiated a rent subsidy policy in 2007 (Executive Yuan, 2007). This provides NT\$ 3000 monthly to lower-income households and was increased to NT\$ 3600 in 2009. However, the amount of rent subsidy is much less than the average rent for comfortable housing in the rental market. The average monthly rent reported by renters in our sample of households is about NT\$ 12 000.

2.4 House Prices and Rents

Although house prices are high relative to household incomes in most Taiwanese cities, the vast majority of households still choose to buy a house. For our sample of homeowners, estimated house prices are about 4.3 times total household income. As already noted, Hsueh and Chen (1999) found that expected growth in house prices encouraged the rise in homeownership rates between 1982 and 1993. Although house prices have been somewhat volatile in recent decades,

overall nominal house prices increased by 481 per cent in Taipei City between 1980 and 2007 (see Figure 2). The nominal annual compound growth rate of house prices was 6.73 per cent during this period. The average mortgage interest rate was 7.49 per cent, while the average savings account interest rate was 6.1 per cent over the same period. Many Taiwanese believe that, while real estate prices can fluctuate dramatically in the short run, they have an increasing trend in the long run. Compared with stocks or other types of investment, real estate is more visible, useable and reliable. Moreover, on average between 1980 and 2007, the user cost of owner-occupied housing was very close to zero, due in part to the high rate of house price inflation. As we will show, even in 2002, when inflation expectations were uncertain, the user cost averaged only 3.4 per cent.³

According to the annual Income and Expenditure Survey of Taiwan, the average rent-to-price ratio was 5.78 per cent between 1980 and 2007, which is much lower than the average mortgage interest rate or the average savings account interest rate during the same period. For an investor in housing, this means that the rental return has been stable but low, even lower than the riskless savings interest rate, while the capital gain has been high but risky. Because the rental returns are fairly low and the legal environment for landlords not well developed, there is no incentive for the establishment of professional rental companies. Consequently, most landlords are individuals who happen to own houses of relatively poor quality that would otherwise be vacant. Any household desiring a good-quality living environment is forced to become a homeowner.

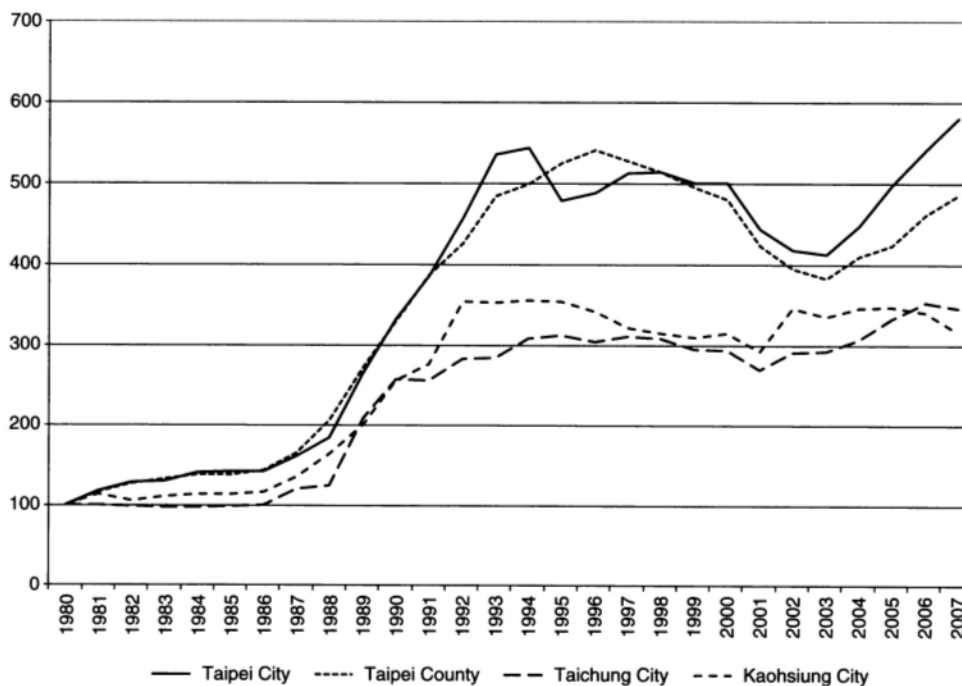


Figure 2. Median house prices, 1980–2007.

Source: Quarterly Real Estate Price Transaction Report, Department of Land Administration, Ministry of the Interior, R.O.C. (various issues).

2.5 Housing Demand

Owner-occupiers' housing demand in terms of physical space is fairly modest in Taiwan compared with the US, for example. For our sample of owners, the median dwelling size is 32 ping, which is about 106 square metres or 1173 square feet.⁴ For renters, it is 28 ping, which is about 92 square metres or 1027 square feet. In contrast, owners in the US in 2003 occupied a median of 1821 square feet, while renters occupied 1299 square feet (US Bureau of the Census, 2003). Across both tenures, the median in Taiwan is 1137 square feet versus 1755 in the US (1779 for urban areas in the US). Generally, owners in the US occupy substantially more space than owners in Taiwan (55 per cent more) or, for that matter, renters in the US (40 per cent more). In contrast, owners in Taiwan occupy only about 15 per cent more space than renters in Taiwan. Both owners and renters in Taiwan tend to live in apartments, with median lot sizes of only 6 and 7 ping respectively (257 and 220 square feet), or much less than the median floor areas.⁵ Consumption of modest amounts of space seems a reasonable response to the fact that prices are high relative to incomes.

3. Tenure Choice Model

3.1 Modelling the Probability of Homeownership

In this study, housing tenure choice is modelled as a function of the relative cost of owning and renting, the borrowing constraint gap, household after-tax permanent income and several demographic characteristics of households. We follow the general modelling approach applied by Bourassa and Yin (2008) to the US or Bourassa and Hoesli (2010) to Switzerland. Household income enters the model both directly (because the preference for owner-occupation may increase with income) and indirectly through variables measuring the relative cost of owning and

renting (the user cost of owner-occupied housing is a function of income because it depends on the household's income tax bracket) and borrowing constraints (which are a function of income). We control for the possible endogeneity of income and wealth by substituting estimated values in place of the actual measures when calculating relative cost ratios, borrowing constraints and after-tax household income. The demographic variables include the marital status, age and gender of the household head, and the numbers of persons, dependent children and elderly in the household.

The tenure choice model is

$$\Pr(\text{OWN}) = f(\text{RELCOST}_j, \text{GAP}_j, \text{ATI}_j, D_j) \quad (1)$$

where, $\Pr(\text{OWN})$ refers to the probability of ownership; RELCOST_j is household j 's annual cost of owning a standard house divided by the annual cost of renting a standard house in the household's area; GAP_j is equal to the magnitude of the gap between the household's predicted house value and the maximum value it can afford given its income and wealth and mortgage underwriting criteria; ATI_j is the permanent after-tax income calculated as if each household were an owner-occupier; and D_j is a vector of the demographic variables listed above. The model is estimated using a logistic regression procedure.

3.2 Relative Cost of Owning and Renting

The relative cost ratio is the price for a standard dwelling in the household's area, $P_{\text{STD},j}$, multiplied by the household's annual user cost per dollar of investment in homeownership, $u_{\text{OWN},j}$, and divided by the annual rent for a standard dwelling in the household's area, $R_{\text{STD},j}$, multiplied by the household's cost per dollar of rent paid, $u_{\text{RENT},j}$

$$\text{RELCOST} = \frac{P_{\text{STD}} u_{\text{OWN}}}{R_{\text{STD}} u_{\text{RENT}}} \quad (2)$$

where the household and locational subscripts (j and l respectively) are omitted (henceforth we will omit these subscripts from all equations).

The household's annual user cost per dollar of investment in an owner-occupied house is defined as

$$u_{OWN} = (1 - \tau_Y)(1 - v^*)i_E + v^*i_F + \mu + \tau_L\lambda\pi_L - \pi_P \tag{3}$$

where, τ_Y is the household's tenure choice income tax rate; v^* is the household's present-value-equivalent loan-to-value ratio; i_E is the rate of return that could be earned on alternative investment of the equity; i_F is the mortgage interest rate; μ refers to housing costs other than mortgage interest, which are defined here to include property taxes, maintenance costs and hazard insurance premiums; τ_L is the annualised effective land value increment tax rate; λ is the proportion of total property value attributed to assessed land value; π_L is expected growth in assessed land value; and π_P is the expected rate of capital gains in total property value (land plus improvements).

The first term on the right-hand side of equation (3) is the opportunity cost of equity, which is after-tax because the returns to alternative investments would generally be taxed. The second term is the cost of mortgage interest. Mortgage interest is not after-tax because, as already argued, the link between the savings and investment deduction and the mortgage interest deduction means that the latter is effectively not a benefit to home buyers. The third term refers to housing expenses. The fourth and fifth terms refer to the land value increment tax and expected capital gains respectively.

The tenure choice tax rate measures the tax advantage of owning relative to renting; it is defined as the difference between the income tax that a household would pay if it were renting versus the tax it would pay if it were

owning, divided by the difference between the taxable income as a renter and as an owner (Hendershott and Slemrod, 1983).⁶

Focusing now on the cost of renting, the annual user cost per dollar of market rent paid, u_{RENT} , equals 1, with two exceptions. As already noted, rent is partially deductible from income for tax purposes. Furthermore, rents may be subsidised for households that meet certain criteria. Therefore, the rental user cost is

$$u_{RENT} = (1 - \tau_Y)\rho \tag{4}$$

where, ρ is the amount of rent that can be deducted after considering the rent subsidy, expressed here as a proportion of the rent paid. In the absence of information about the distribution of rent subsidies, we assume $\rho = 1$.

3.3 Borrowing Constraints

Mortgage underwriters impose both wealth and income constraints on borrowers. Previous research has documented the impacts of borrowing constraints on home mortgage rates (Linneman and Wachter, 1989; Bourassa, 1995; Haurin *et al.*, 1997). The wealth constraint is defined as

$$W \geq 0.22H \tag{5}$$

where W is the household's liquid wealth; and H is the value of the household's preferred house. The constraint requires a minimum of 20 per cent of the value of the house in equity, plus an additional 2 per cent of the value for closing costs, consisting mainly of brokerage and registration fees.

The income constraint is defined as follows

$$0.33Y = (H - W) \left(\frac{i_F}{1 - \frac{1}{(1 + i_F)^{20}}} \right) + 0.01H \tag{6}$$

where Y is household income and the other terms are as defined earlier.

This assumes annual mortgage payments (to simplify the calculations) and housing expenses (maintenance, property taxes and insurance) of 1 per cent per year. The wealth and income gaps are calculated by solving inequalities (5) and (6) for H and then subtracting the result from H . The borrowing constraint gap is then defined for the purpose of estimating the tenure choice equation as the maximum of the wealth and income gaps.

3.4 Household Income and Other Variables

In addition to relative cost ratio and borrowing constraint gap variables, the tenure choice equation also includes a variable measuring after-tax permanent income calculated as if each household were an owner. This is hypothesised to have an effect on tenure choice independent of the other economic variables because the taste for privacy and control over domestic space may be a function of income. This variable is permanent income as an owner as calculated for the purpose of the tenure choice income tax rate less the taxes that would be paid as an owner.

As already mentioned, the demographic characteristics included in the model are marital status, gender and age of the household head, and the numbers of persons, dependent children and elderly individuals in the household. Marital status is defined using three dummy variables for married, separated or divorced and widowed, with single being the default category. Research in other countries has shown that single and separated or divorced persons are less likely to be homeowners than married or widowed persons. Age is defined using four dummy variables: 30 to 39, 40 to 49, 50 to 59 and 60 to 65, with less than 30 as the default category. Households headed by persons older than 65, who are generally retired, or younger than 20, who are generally in school, are excluded

from the sample. The probability of ownership should increase with age, as individuals become more settled in their careers and personal lives. Also, the addition of children to a household implies greater stability and may be associated with ownership. The numbers of persons and elderly in the household may reflect additional resources available to support homeownership or else additional demands on limited resources; hence, the expected signs of the estimates for these variables are uncertain.

3.5 Endogeneity Issues

Bourassa (2000) suggests that current income and wealth can be endogenous in a model of tenure choice. Households may work more hours and save more if they decide to purchase a home. Also, amortising a mortgage builds up wealth in the form of home equity. To avoid potential endogeneity problems, we use predicted liquid wealth and permanent household income to calculate the borrowing constraint gap (see Haurin *et al.*, 1997, or Bourassa and Hoesli, 2010, for other examples of this approach) and the tenure choice tax rate and to estimate and predict house values and rents for each household in the sample. The predicted house values are used when calculating the borrowing constraint gap and both predicted house values and predicted liquid wealth are used to calculate hypothetical loan-to-value ratios.⁷

4. Data and Constructed Variables

4.1 Data

Our primary data source is the 2002 Income and Expenditure Survey of Taiwan. We focus on the four main population centres: Taipei City, Taipei County, Taichung City, and Kaohsiung City.⁸ Of the 13 681 households participating in the survey nationwide, 4678 were located in the areas we focus on here, provided sufficient data for analysis and

satisfied our requirement that the household reference person be of working age (between 20 and 65) and in the labour force. We also deleted observations for households living in government-supplied housing or free housing supplied by private companies (for example, by employers).⁹ The survey provides detailed information about household revenues and their sources as well as details regarding household expenses and household characteristics.

The survey does not document household wealth, although it does provide indirect information about wealth by recording details about income from wealth. Here, we use income from selected sources to impute liquid wealth, using i_E as the capitalisation rate. Also, no information is provided about the value of owner-occupied dwellings. However, imputed rents are provided for homeowners and these are used to capitalise their values, using capitalisation rates that we calculate using information about median prices and rents for comparable properties.

Means for the variables in the tenure choice equations are shown in Table 2. Ownership rates are relatively high in Taipei County and Kaohsiung City compared with Taipei City or Taichung City. Relative cost ratios vary substantially across locations, due largely to variations in the ratios of prices to rents. Borrowing constraint gaps are consistently negative on average, with a mean of NT\$ -3.33 million (equivalent to about US\$ -106 000). This means that the average household has somewhat more income and wealth than needed to purchase a house. Demographic characteristics are fairly constant across locations, although household heads in Taipei City are older on average than in the other places and households in that city have fewer children and family members. However, after-tax permanent income (calculated as if each household were a homeowner) is highest in Taipei City.

The last two columns of Table 2 compare owners with renters. The differences between owners and renters are mostly consistent with what one would expect, although owners have fewer children than renters and renters have a negative borrowing constraint gap, on average. The latter is due to the fact that the gap is calculated using permanent income and predicted liquid wealth, rather than the actual values for those variables. If the gap were calculated using actual income and liquid wealth, renters would have a positive gap on average. Owning households are much more likely than renting ones to have heads that are married, male and in the oldest age-groups, and to have more family members and older people.

4.2 Relative Cost Ratio

Table 2 lists the average relative cost ratio for each location in our sample and the entire sample, as well as for owners and renters. Taipei County, which has the highest average relative cost ratio, also has the highest house price-to-rent ratio (34.6, compared with an overall average of 31.7). Note that the difference in relative cost ratios between owners and renters would be much more pronounced if the user cost were based on actual, rather than permanent, income.

The tenure choice tax rates are relatively low, averaging only about 7.4 per cent in a system where marginal tax rates range from 6 per cent to 40 per cent, suggesting that households are typically able to exclude much income from taxation. The higher average tax rate in Taipei City, 11.1 per cent, reflects the significantly higher incomes there.

The present-value-equivalent loan-to-value ratio is calculated based on the observation that equity financing is less expensive than debt financing in Taiwan, which suggests that households probably pay down their mortgages as quickly as possible. The household survey does provide some information about mortgage interest paid which, together with

Table 2. Tenure choice variable means

	Taipei City (n = 1631)	Taipei County (n = 1353)	Taichung City (n = 454)	Kaohsiung City (n = 1240)	Full Sample (n = 4678)	Owners (n = 4072)	Renters (n = 606)
Owner (percentage)	85.4	87.8	84.7	89.2	87.0	100.0	0.0
Relative cost ratio	1.16	1.25	0.75	1.03	1.13	1.13	1.15
Borrowing constraint gap (NT\$)	-3.71×10 ⁶	-2.97×10 ⁶	-3.36×10 ⁶	-3.54×10 ⁶	-3.33×10 ⁶	-3.42×10 ⁶	-2.69×10 ⁶
After-tax permanent income if owning (NT\$)	1.49×10 ⁶	1.08×10 ⁶	1.09×10 ⁶	1.07×10 ⁶	1.20×10 ⁶	1.22×10 ⁶	1.06×10 ⁶
<i>Marital status of household head (percentage)</i>							
Married	74.3	73.7	72.4	72.7	73.6	75.1	63.5
Separated or divorced	6.4	6.6	8.6	6.8	6.8	5.6	14.9
Widowed	2.8	2.4	3.1	4.2	2.9	2.8	3.5
Single (default category)	16.5	17.3	15.9	16.3	16.7	16.5	18.1
Number of persons	3.65	3.85	3.81	3.73	3.77	3.82	3.42
Number of children	0.95	1.09	1.18	1.02	1.05	1.04	1.09
Number of elderly (older than 65)	0.25	0.17	0.22	0.26	0.21	0.23	0.10
Male head of household (percentage)	75.7	80.1	76.8	78.5	78.2	79.5	69.3
<i>Age of household head (percentage)</i>							
20 to 29 (default category)	6.6	10.5	9.5	8.1	8.9	8.4	11.9
30 to 39	24.0	29.5	30.4	27.1	27.5	27.2	30.1
40 to 49	38.1	37.8	39.6	35.5	37.7	37.8	36.8
50 to 59	24.8	19.1	15.9	22.0	20.9	21.5	17.5
60 to 65	6.5	3.1	4.6	7.3	5.0	5.1	3.7

Notes: Data are weighted to make them more representative of the population. The ownership rates listed here are higher than those depicted in Figure 1 due to the fact that our sample excludes the 'other' tenure category as well as households with heads older than 65.

Source: Authors' calculations based on 2002 Income and Expenditure Survey of Taiwan.

imputed house values, can be used to estimate loan-to-value ratios for current owners. This calculation yields an average loan-to-value ratio of 0.218. However, this is undoubtedly a significant overstatement of the typical loan-to-value ratio, because the mortgage interest variable includes interest on any mortgage debt and so may combine interest

paid for the primary home with interest paid for investment properties and second homes. When we calculate loan-to-value ratios using predicted liquid wealth and an assumption that households use liquid wealth to pay down their mortgages as quickly as possible, then our average ratio for current owners is 0.143. Assuming a 10-year holding period, and given

that Taiwanese households pay down their mortgages about twice as fast as required, we expect the present-value-equivalent loan-to-value ratio to be roughly 50 per cent of the initial ratio.

In addition to the variables already discussed, equation (3) includes two interest rates, a measure of other housing costs (property taxes, maintenance costs and insurance premiums), the expected assessed land value increment rate, the proportion of total property value attributed to assessed land value, the annualised land value increment tax rate and the expected total property capital gains rate. The rate of interest that would be earned on alternative investments of home equity is set at 0.0238, which is the one-year fixed savings interest rate for 2002. The mortgage interest rate is set at 0.04401. Both of these rates are based on Taiwan Central Bank statistics. Other housing costs are estimated to be approximately 1 per cent per year. We assume that the expected land value increment and total property

capital gains rates were zero in 2002, given that there was uncertainty at the time about future house price movements (see Figure 2). This means that we do not need to make assumptions about the proportion of total property value attributed to assessed land value or the annualised effective land value increment tax rate.

The rental user cost in equation (4) reflects the after-tax impact of the rent deduction on rents. This is calculated using predicted rents. On average, the deduction reduces rental user costs by 5.7 per cent (to 0.943).

4.3 Borrowing Constraint Gap

As already noted, the borrowing constraint gap is defined as the maximum of the wealth and income gaps. Solving each of the constraints in equations (5) and (6) for H and then subtracting the results from H yields the wealth and income gaps respectively. Substituting the predicted house value, \hat{H} , permanent income, \hat{Y} , and predicted liquid wealth, \hat{W} , for H , Y and W respectively, the gap is

$$GAP = \max\left(\hat{H} - \frac{\hat{W}}{0.22}, \hat{H} - \left(\left(0.33\hat{Y} + \hat{W}\left(\frac{i_F}{1 - 1/(1 + i_F)^{20}}\right)\right) / \left(\left(\frac{i_F}{1 - 1/(1 + i_F)^{20}}\right) + 0.01\right)\right)\right) \quad (7)$$

5. Tenure Choice Results and Simulations

5.1 Tenure Choice Results

The tenure choice estimates are shown in Table 3. The models were estimated first with after-tax income as an owner included as an explanatory variable as in Equation (1). However, this variable either was significant with the wrong (negative) sign or else insignificant. We attribute this to collinearity with the relative cost ratio and borrowing constraint gap variables. Given that the latter two variables appear to have more explanatory power than the income variable, we omitted the income variable from our final set of estimations.

Model 1 shows the estimates for equation (1) excluding the after-tax income variable. We note that the borrowing constraint gap estimate is significant, but the relative cost ratio is not. Given that households may respond differently to the out-of-pocket and opportunity cost components of the user cost (Börsch-Supan, 1987), we separate the relative cost ratio into two components and include them both in model 2. In this case, the out-of-pocket or cash component has a negative and significant impact as one would expect, but the opportunity cost component is positive and significant. This suggests that the latter is functioning not as a cost but more likely as a proxy for wealth (given that a high

Table 3. Tenure choice estimations

Variables	Model 1 (n = 4678)	Model 2 (n = 4678)	Model 3 (n = 4678)
Constant	0.337	-0.203	1.669***
<i>Relative cost ratio</i>	0.043	—	—
Opportunity cost component	—	4.565***	—
Cash component	—	-5.618***	-2.740***
Borrowing constraint gap	-0.187***	-0.042	-0.113***
<i>Marital status of household head</i>			
Married	-0.173	0.075	-0.060
Separated or divorced	-0.722***	0.339	-0.378*
Widowed	-0.018	0.334	0.089
<i>Age of household head</i>			
30 to 39	0.361**	0.059	0.263
40 to 49	0.574***	-0.035	0.373*
50 to 59	0.595***	-0.200	0.324
60 to 65	0.893***	-0.096	0.511
Male head	0.219*	0.288**	0.254**
Number of persons	0.166***	0.369***	0.241***
Number of children	-0.191***	-0.236***	-0.223***
Number of elderly persons	0.677***	0.646***	0.642***
Log likelihood function	-1,703.0	-1,660.9	-1,692.0
Chi-squared	205.3***	289.4***	227.3***

Notes: *, ** and *** indicate significance at the 10 per cent, 5 per cent and 1 per cent level respectively. The borrowing constraint gap estimates should be multiplied by 10^{-6} .

Source: Authors' calculations based on 2002 Income and Expenditure Survey of Taiwan.

opportunity cost of equity indicates high wealth). Consequently, we estimate model 3 with only the cash component of the relative cost ratio.

The remaining variables perform mostly as expected. Interestingly, married and widowed persons are no more likely to be homeowners than single persons, although separated or divorced persons are less likely to be homeowners. The other interesting finding is that the number of children is negatively associated with homeownership. Both of these results differ somewhat from findings from similar models estimated for Western countries. Studies of Australia, Switzerland and the US using similar models and data have concluded that married couples were more likely than single persons to be homeowners and that the number of children is either positively

associated with the probability of ownership or else there is no relationship (Bourassa and Yin, 2006; Bourassa and Hoesli, 2010). Indeed, using a somewhat different modelling approach, Hsueh and Chen (1999) concluded that married couples were more likely to be owners than single persons in both 1982 and 1993. It seems, however, that ownership has become so attractive in Taiwan that single persons no longer wait until marriage to purchase a home.

With respect to the other variables in model 3, the probability of ownership increases with the numbers of persons and elderly persons in the household. The probability is also significantly higher if the household head is male. Holding everything else constant, there is not a strong relationship between ownership and the household head's age.

5.2 Simulation of Changes in Tax Policy, Price Levels and Price–Rent Ratios

The estimates shown in Table 3 for model 3 are then used together with modified variable values for the purpose of simulating hypothetical changes. These simulations help us to understand what is driving Taiwan's homeownership rate. We use bootstrapping (see, for example, Efron and Tibshirani, 1993; Mooney and Duval, 1993) to calculate confidence intervals for the simulated ownership rates based on hypothetical changes to tax policy or house prices and rents (Table 4).

We first simulate the impacts of making the wealth and income constraints, both separately and together, more binding. Raising the downpayment constraint from 22 per cent

to 32 per cent would have negligible impact on the ownership rate, reflecting that these constraints are not serious for many households. Tightening the income constraint to allow mortgage principal, interest and other expenses to be no more than 25 per cent of gross income (rather than 33 per cent) would cause the ownership rate to drop by about 2.1 percentage points. Although this represents a small change in practical terms, it is significantly different from the actual ownership rate. Raising the downpayment constraint to 32 per cent while also tightening the income constraint to 25 per cent would have the same impact.

We next simulate the effect of increasing the effective property tax rate by 1 percentage

Table 4. Simulation results

	<i>Taipei City</i>	<i>Taipei County</i>	<i>Taichung City</i>	<i>Kaohsiung City</i>	<i>Full sample</i>
Actual ownership rate (per cent)	85.4	87.8	84.7	89.2	87.0
Predicted ownership rate (per cent)	87.2	85.0	90.4	89.8	87.0
Change downpayment constraint to 32 per cent	87.2	85.0	90.3	89.7	87.0
Change income constraint to 25 per cent	84.5	82.9	89.0	88.2	84.9*
Change down payment constraint to 32 per cent and income constraint to 25 per cent	84.5	82.9	89.0	88.2	84.9*
Increase effective property tax rate by 1 percentage point	73.1	68.9	84.3	79.7	73.6*
Expected house price growth rate equals -1 per cent	73.1	68.9	84.3	79.7	73.6*
Mortgage interest rate drops by 0.5 percentage points	87.6	85.5	90.6	90.0	87.4
Capitalization rates increase by 50 per cent	91.3	89.8	92.6	92.5	91.0*
Allow full deductibility of mortgage interest	87.6	85.3	90.5	89.9	87.3
Tax imputed rent but allow deductibility of expenses	85.1	83.7	89.3	88.6	85.6*
Eliminate rent deduction	88.1	86.0	90.8	90.3	87.9*

Notes: The simulation results for each of the sub-samples should be compared with the predicted ownership rates for those locations. For the full sample only, * indicates that the simulated result differs significantly from the actual ownership rate (based on bootstrapped 95 per cent confidence intervals).

point, which has the same impact as assuming that expected house price growth is -1 per cent (rather than zero growth). In both cases, the simulated ownership rate drops significantly, by 13.4 points. These are by far the largest impacts obtained from any of our simulations. Of course, it is extremely unlikely that households would expect negative price growth over an extended period of time and the impact of the higher property tax rate would be mitigated somewhat by capitalisation of the tax into lower land values.

We then examine the impact of lowering mortgage interest rates by 50 basis points (in this case, from about 4.4 per cent to 3.9 per cent). This is a rough test of the government's mortgage interest subsidy policy, with a similar reduction in interest rates, but assuming that all rather than just some households benefit from the subsidy. This simulation does not have a significant impact on the ownership rate, raising questions about whether the government's policy is effective. Next, we decrease price-to-rent ratios by increasing capitalisation rates by 50 per cent. In other words, instead of having capitalisation rates of only 3.2 per cent and price-to-rent ratios of 31.7 on average, the capitalisation rates and price-to-rent ratios would average 4.8 per cent and 20.8 respectively. According to our simulations, this would increase the ownership rate by 3.4 percentage points.

Next, we explore two possible changes to the income tax treatment of owner-occupied housing. First, we simulate allowing full deductibility of mortgage interest, with the interest deduction being independent of the savings and investment deduction. This has a negligible impact on the ownership rate, mainly because households have so little mortgage debt.¹⁰ Secondly, we simulate a tax on imputed rent while simultaneously allowing deduction of mortgage interest and other expenses, with other expenses limited to 1 per cent of property value. The tax on imputed rent is calculated using the

capitalisation rate for each location. In this case, the ownership rate drops by 1.4 percentage points, a significant but small change.

Finally, we simulate elimination of the rent deduction. The effect of this is a statistically significant, but small, increase in the ownership rate.

6. Conclusions and Policy Implications

While the Chinese Taiwanese predilection for saving and investment, particularly in real estate, undoubtedly helped to set the stage for Taiwan's high ownership rate, we conclude that it was the low user cost of ownership that made the high rate possible. The average user cost was quite low during the 1980–2007 period, due in part to high expected house price inflation. Hence, our conclusions are quite consistent with those of Hsueh and Chen (1999). Our simulations suggest that the only changes that would have a significant effect on the ownership rate, in both practical and statistical terms, are those that would increase the user cost significantly. Of the simulations we tested, such changes would include large increases in the property tax rate or negative expected house price growth. A percentage point increase in the property tax rate or an equivalent -1 per cent price growth expectation reduces the ownership rate by about 12 percentage points.

We also note that Taiwanese households appear to be sensitive to the cash portion of the user cost but not the opportunity cost portion. Taking this into account, the effective user cost in 2002 would have been less than zero had house price inflation expectations been greater than 1.3 per cent. Between 2003 and 2007, house prices generally grew at rates much greater than this in Taipei City, Taipei County and Taichung City. They did not grow during that period in Kaohsiung City and, indeed, have not grown in that city since 1992. If this trajectory continues, Kaohsiung City

will be a particularly interesting case because it will have relatively high user costs, which may translate into a reduced ownership rate, depending on the price-to-rent ratio.

Our simulations suggest that the mortgage subsidy programme is unlikely to have contributed to the high ownership rate. An across-the-board reduction in the mortgage interest rate of 50 basis points (similar to the value of the subsidy for the limited number of households that receive it) does not have a significant impact. We also question the housing pre-sale system's role as a possible contributor to Taiwan's high ownership rate as it actually requires purchasers to pay towards a downpayment significantly in advance of acquiring the property, which imposes a cost rather than confers a benefit.

Some aspects of the tax system contribute to the low user cost and high rate of ownership. Low property taxes are evidently a significant factor as an increase from an effective rate of 0.11 per cent to over 1 per cent would be likely to reduce ownership rates substantially. We conclude that the mortgage interest deduction is not a significant factor due to the way it is linked in the tax rules to the savings and investment deduction. In effect, this deduction is not limited to home buyers.

Finally, we concur with the view that Taiwan's emphasis on homeownership has limited the options in the rental sector, meaning that households often do not have a good alternative to buying a house. In this respect, the high ownership rate is to some extent self-reinforcing because it forces some individuals or households to purchase even if renting might be more suitable for them if good-quality rental housing were available.

The preceding analysis leads to several policy recommendations. Leaving aside the question of why the Taiwan government has policies designed to encourage the ownership rate when the rate is already quite high, it is doubtful that two of the existing policies are having the desired effect. Neither the

mortgage subsidy programme nor the mortgage interest deduction is likely to have significant impacts on the ownership rate. As we have argued, the latter is linked to the savings and investment deduction in such a way that the deduction is for the most part available to both renters and owners and, therefore, by definition does not provide a special advantage to owners.

We do not recommend establishing an imputed rent tax. This would entail allowing deductibility of expenses, including mortgage interest, and on balance would have a small impact while increasing the complexity of the income tax system unnecessarily. This leaves the options of increasing the land value increment tax or the property tax. We do not recommend increasing the land value increment tax rate given the impact that it is likely to have on household decisions about when to move and sell a home. On the other hand, increasing the property tax, particularly the portion applied to land, would increase the user cost somewhat without causing any deadweight loss to the Taiwan economy (see, for example, Oates and Schwab, 2009, for a recent discussion of the theory of land value taxation).

Recent events would not change our conclusions as Taiwan's housing markets were only slightly affected by the global financial crisis. House prices dropped in all the major cities and nationally between the end of 2007 and the beginning of 2009, but they quickly recovered and now generally exceed their 2007 levels. Consequently, the homeownership rate is unlikely to have been affected to a significant extent.

Notes

1. As of 30 April 2010, NT\$ 1.00 \approx US\$ 0.0318.
2. These rates have been reduced to 20, 30 and 40 per cent.
3. The user cost is the annual cost per dollar of home value.
4. 1 ping \approx 3.3 square metres or 36.7 square feet.

5. For apartments, the lot sizes represent the portion of the lot attributable to each unit. The housing demand data for Taiwan are based on the 2002 Income and Expenditure Survey of Taiwan.
6. Details about the calculation of the tenure choice tax rate are available from the first author.
7. Details about the income, wealth, house value, and rent estimations are available from the first author.
8. We treat these as separate markets, although Taipei City and County could be considered to be parts of the same market. This assumption affects the price-to-rent ratios used to calculate the relative cost ratio variable; however, the price-to-rent ratios are virtually the same for Taipei City and County, so the assumption does not matter.
9. Hence, the ownership rates calculated for our sample are higher than the actual rates.
10. Of course, households may change the way they finance owner-occupied housing depending on how expensive debt is relative to equity, and allowing deductibility of all mortgage interest would reduce the relative cost of debt (see Dunsky and Follain, 2000).

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