INTERNATIONAL REAL ESTATE REVIEW
2000 Vol. 3 No. 1: pp. 11 - 33

The Relationship between Housing Price, Tenure Choice and Saving Behavior in Taiwan

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The purpose of this research is to empirically test whether house price increases are an important factor in a household's savings decisions and whether housing tenure choice and savings behavior are inter-correlated in Taiwan.

Heckman's two-stage procedure for correcting sample selection bias is used in the estimation of savings function for homeowners and renters. Household survey data from 1985, 1989 and 1993 are used to compare households' saving behavior at different times.

The empirical results show that in some cases the coefficients of the two different definitions of house price increases have opposite signs. These differences may be the result of different behavior motives. House price increases with respect to the price of the house itself seem to cause concern among households about future housing prices; hence, increase their savings ratio. House price increases with respect to income, however, seem to cause a wealth effect and then decreased savings ratio. Considering the complexity of households' reaction, the overall effect of house price changes on the aggregate savings ratio becomes impossible to determine.

Keywords

Housing Price, Tenure Choice, Household Saving Behavior, Hedonic Price Method, Sample Selection Bias.

Introduction

Housing prices in Taiwan increased substantially in the late 1980s and early 1990s, and stayed at a high level until the mid-1990s, after which time they fell slightly in some parts of Taiwan. The ratio of the median housing price over income reached its highest point in 1989, at 8.58 (Hsueh, 1996). Was household savings behaviors affected by the sharp increase in the housing price in this period?

Since the sudden housing price hike, which started from 1987, a household now needs to provide a substantial sum for a down payment before it can actually take action and buy a house (if it is not a current homeowner). Even if it is a homeowner, a household still needs to pay a considerably larger sum than previously in order to move into a new higher quality home. However, house price increases do bring capital gains to homeowners. According to the life-cycle hypothesis, saving is done for the purpose of building financial security for life after retirement. Capital gains from house price increases thus reduce the need for non-housing savings. However, if a household has a bequest motive and cares about the future housing price of its heirs, it will not spend all of its housing capital gains. Therefore, house price increases may have either a positive or a negative effect on household savings depending on the household's current tenure status and on the extent of its bequest motive.

Since the home ownership rate in Taiwan is about 80%, if the life-cycle hypothesis is true, then the sharp increase in the housing price in the late 1980s would have had a significant effect on the aggregate savings rate. This conjecture seems to coincide with the two-digit growth rate of private consumption of the late 1980s.[1]

The purpose of this research is to empirically test whether and to what extent house price increases are an important factor in a household's savings decisions in Taiwan and whether or not housing tenure choice and savings behavior are inter-related.

Heckman's two-stage procedure for correcting sample selection bias is used in the estimation of savings function for homeowners and renters. Household survey data from 1985, 1989 and 1993 are used to compare households' saving behavior at different times. The result of econometric estimation shows that the sharp increase in housing price in the late 1980s do have an effect on

[1] The growth rate of private consumption expenditure was 11.18%, 13.42% and 13.06% in 1987, 1988 and 1989, respectively. The GDP growth rate for these respective three years, meanwhile, was 12.74%, 7.83% and 8.23%.

households' saving behavior, however, the overall effect of house price changes on the aggregate savings ratio is impossible to determine.

This paper is organized as follows: in section two, relevant theories and the literature are examined; in section three, we present a model of housing demand and lifecycle consumption; and section four describes the data, the steps taken in the empirical research, and the empirical results. Some concluding remarks round off the study.

Literature Review

First, let us look at studies on the influence of housing price on homeowners. Bhatia (1987) and Hendershott & Peek (1989) both estimate the consumption function using time series data. They include housing asset as an explanatory variable in the consumption function. The results show that housing assets significantly influence consumption.

Jonathan Skinner (1989) uses data from the Panel Study of Income Dynamics (PSID) to study the influence of house price on consumption from the point of view of a household unit. He finds that the results differ with different kinds of regression function. Therefore, he concludes that it is uncertain whether housing price does actually affect household consumption. Skinner explains that homeowners do not consume their housing wealth probably because they are unable to cash in on it. He suggests that it may also be possible that homeowners do not consider house price increases to be permanent.

Gary Engelhardt (1996) also uses PSID data. His paper suggests that real household non-housing saving is inversely related to real housing capital gains, but that there is an asymmetry in the saving response to real housing capital gains. He finds that savings increase when households experience real housing capital losses, and that this is done in order to offset those losses. On the other hand, households that experience real gains do not change their saving behavior.

Louise Sheiner (1995) studies the effects of housing price on the savings of renters. Also using PSID data, she finds that the effect of increased housing prices on saving behavior is positive. More specifically, it is suggested that young renter households in cities with high housing prices have more net worth than those in cities with lower housing prices, other factors being controlled. This tells us that renter households in cities with high housing prices need to save more than those in cities with lower housing prices because of the need to pay a higher price in order to buy a house.

Krumm & Kelly (1989) suggests that it would be better to empirically estimate the savings function and tenure choice simultaneously, since the decision to either own or rent a residence and household savings are inter-correlated.

As for the literature on related topics in Taiwan, Wang, Wei-han and Lee, Er-lien (1987) looks into savings motives to find that 13.37% of households save towards the purchase of owner-occupied housing. Lo, Chi-chiung (1983) empirically estimates the savings function in Taiwan, finding that home owning has a negative effect on saving. Hsueh, Li-Min and Chen, Hsiu-li (1998) investigates the tenure choice and consumption behavior of households, concluding that the consumption pattern on various categories of expenditure differs significantly for homeowners and renters.

In all, it is clear that the relationship between housing price, tenure choice and saving behavior in Taiwan has yet to be studied in-depth. This paper sets out to undertake such a study.

Theoretical Analysis

It is not easy to find a comprehensive model describing the complex relationships between housing price, tenure choice and saving behavior. The model suggested by Skinner (1989), however, is relatively complete. In the present paper, his model is adopted and slightly modified to explain how house price increases can affect the savings of a household. According to Skinner, the utility function of a consumer can be specified as follows:

$$U = \sum_{i=1}^{T} (1+d)^{1-i} \ln(H_i^{a} C_i^{1-a}) + (1+d)^{1-T} b_0 \ln\left(B - b_1 Q_{T+b}\right) \qquad (1)$$

In this utility function, a consumer not only gains satisfaction from housing (*H*) and other consumption (*C*), but also from bequest (*B*) and the heirs' purchasing price of the house (*Q*). This specification implies that the consumer is concerned about the housing price of his heirs. If the consumer expects that the housing price will be a lot higher at heirs' age, he/she will save more for bequest. Then he/she will not spend all of his capital gains from housing at the end of his/her life. Meanwhile, Equation (1) assumes that every consumer has a life span of T years; the consumer purchases his/her residence at b years of age and lives there all of his/her life. Further, d is time preference, and a is the proportion of expenditure allocated to housing. If we do not consider the effect of bequest, then ß = 0, otherwise ß ? 0.
The budget constraint can be expressed in Equation (2):

$$\sum_{i=1}^{T}(C_i + P_i H_i)(1+r)^{1-i} + B(1+r)^{1-T} = [I_1 + \sum_{i=1}^{T} Y_i(1+r)^{1-i}]$$
$$+ \sum_{j=b}^{T} P_j(1-q-m)H_b(1+r)^{1-i} + Q_{T+1}(1+r)^{1-T} H_b - y Q_b H_b(1+r)^{1-b}$$
$$-(1-y)Q_b H_b \sum_{i=b}^{T} r_m(1+r)^{1-i} - (1-y)Q_b H_b(1+r)^{1-T} \qquad (2)$$

Here, P_i denotes the spot unit price for renting a house, ? and *m* are the tax rate and maintenance fee, respectively, *?* denotes the down payment proportion of the housing price, Q_b is the unit price when buying a house at age *b*, r_m is the interest on the mortgage, and *r* is the discounting rate. The left-hand side of Equation (2) measures the expenditures of a consumer, including housing consumption, other consumption, and bequest. The right-hand side of the Equation reflects the incomes of a consumer, including inheritances (*I*), earnings (*Y*), the imputed rent from owning a house during his/her life span, and the sale price of housing at the end of his/her life minus the costs of housing (i.e., the down payment, mortgage payments and the repayment of the principal).

Assuming that we have a model of perfect foresight, i.e. $r_m = r$, and that $Q_t = \sum_{j=t}^{\infty} P_j(1-q-m)(1+r)^{t-j-1}$, then Equation (2) can be simplified as follows:

$$\sum_{i=1}^{T}(C_i + P_i H_i)(1+r)^{1-i} + B(1+r)^{1-T} = I_1 + \sum_{i=1}^{T} Y_i(1+r)^{1-i} \qquad (3)$$

The first order conditions of (1) and (3) can be solved to find the functions of C_i, H_i and *B* of a consumer in the steady state.[2] However, we are not interested in knowing the result in the steady state. We are interested in knowing what the effect on consumption will be when the economic system undergoes change. Skinner (1989) solves a generalized solution for consumption in year *t* at age *i* for any consumer. This solution can be expressed as follows:

[2] The result of the first order condition can be found in Skinner (1989).

$$C_{it} = D^{-1} d(1-a)[A_{it}(1+r) + \sum_{j=0}^{T+1-i}(Y_{i+j,t+j} - zH_b P_{t+j})(1+r)^{-j} - (1+r)^{i-T}$$

$$b_1 Q_{1+T-b-i}\,] \qquad (4)$$

$$D = (1+d) - (1+d)^{i-T} / (1-z\,a)$$

Equation (4) indicates that once a change occurs, consumers along the transition path will be affected differently from one another, depending on their age at the time of change. C_{it} is the consumption in year t and at age i, and A_{it} is the consumer's assets in year t and at age i.[3] ?=1 is homeowners, and ?=0 is renters. The term Y_{it}-?$H_b P_{t+j}$ means that for a homeowner, consumption is constrained by the chosen quantity of housing. Hence, housing related expenditure must be subtracted from income (*Y*). The term $Q_{1+T+b-i}$ represents the present value of the future heirs' housing price.

Now let us consider the effects when housing price changes for a homeowner. First, housing related expenditure will not be affected, such as the interest expenditure of home loans given the chosen quantity of housing. Second, capital gains will occur and increase the total assets *A*, and in turn consumption *C* will increase, meaning that savings will decrease at the same time. In the meantime, the housing price for future heirs may also increase and consumption decrease, if the consumer cares about his/her heirs' welfare. The extent of the decrease depends on the value of ß$_1$ and the age of the consumer. The smaller the value of ß$_1$ and the younger the consumer, the smaller will be the effect on consumption. The total effect of housing price change on consumption will equal the discounted present value of the A_{it} minus the ß$_1 Q_{1+T+b-i}$ in the bracket.

Meanwhile, for renters, housing price change will have no effect on the consumption of renters according to Equation (4), because the consumer can adjust his/her housing expenditure easily so as not to affect other consumption. However, if a renter is planning to purchase a house in the future, he/she will need to save more for a higher housing price.

Synthesizing the above discussion, Equation (4) establishes the relationship between house price change and consumption behavior. From the point of view of national account statistics, savings plus consumption equals income. Hence, consumption increase is equivalent to savings decrease, and vice versa. Therefore, we can study directly consumption or savings. The

[3] Assets can be represent by the equation $A_t = A_{t-1} + Y_t + KG_t + INV_t$, where KG_t is housing capital gains, INV_t is the income from other investment.

empirical part of this research studies savings. In the next section, we use actual data to gauge the effect of house price change on household savings during the mid-1980s to early 1990s in Taiwan.

Empirical Analysis

The Data

In order to empirically test the relationships between housing price changes and household savings, the original household data from "The Survey of Family Income and Expenditure in the Taiwan Area of the Republic of China" (SFIE) is used to estimate the savings function. SFIE is an annual government survey of representative sampled households. However, the sampled households are different each year. In other words, it is not a panel sample. For the purpose of comparing household behavior under different housing market situations, survey data from 1985, 1989 and 1993 are used. During the 1987~1989 period, Taiwan experienced a serious housing price increase; for most areas of Taiwan, housing prices increased one to three fold. Therefore, the years 1985, 1989 and 1993 represent, respectively, the time before house prices increased sharply, the time during which house prices increased sharply, and the time after.

Information on income, consumption, savings, housing tenure status, and the housing characteristics of each household are available in the SFIE survey. However, house price data are not available in this report. To remedy this, data from the "Housing Status Survey" (HSS) are used. HSS is another government-conducted household survey, taken annually from 1980 to 1989, and again in 1993, the last year of the survey. In the HSS data set, house price[4] and housing characteristics are available for each household. By applying the hedonic price method on the HSS households, we can estimate the house price and then calculate the price changes for each household in the SFIE data set. The procedure is described in detail in the following section.

[4] In HSS, homeowners were asked when they bought their houses and how much they paid at that time; we therefore use the CPI (Consumer Price Index) and the HPI (Real Regional Housing Price Index) to adjust the housing prices to the survey year. For details, please see Hsueh and Chen (1999).

Steps in the Empirical Analysis

The estimation of price change for each household by employing the hedonic price method

We use data from the HSS to impute housing prices and price changes by employing the hedonic price method for each housing unit with the same characteristics as those found in the "Income and Expenditure Survey". By doing so, we can estimate the price changes for dwellings for each observation in the data set. It accounts not only for changes in the housing price in general in a specific location, but also for the price variations resulting from the change of preference for housing characteristics. The steps taken in calculating the price changes for each household are described below:
First, a hedonic model for housing price is specified as Equation (5):

$$\ln(HP_i) = a_0 + \sum_{j=1}^{k} a_j X_{ij} + e_{ij} \qquad (5)$$

where HP_i. denotes the housing price of individual i, and X_{ij} is the jth housing characteristic of individual i. Second, Equation (5) is estimated for HSS data from 1982, 1985, 1986, 1989 and 1993. Third, we multiply the estimated coefficients of 1982 and 1985 with the housing characteristics of 1985 in the SFIE to obtain the imputed price for each housing unit in the sample. Fourth, we subtract the 1985 price from the 1982 price and divide it by 3 to give the price change for one year for each household in the 1985 SFIE data. Similarly, by repeating step 3 and step 4 for the 1986 and 1989 data pair as well as the 1989 and 1993 data pair, we obtain the price change for each household in the SFIE data for 1989 and 1993.[5] We compare the house prices of 3~4 years separation, because we believe that households may consider that the price changes over only one year are a temporary phenomenon, and hence do not respond to these changes.[6] The results of the hedonic regression are presented in Appendix 1.

[5] For 1985 and 1989 data, the house prices of 3 years previously, i.e. 1982 and 1986, are compared to find the price changes. However, for 1993 data, the prices of 4 years previously, i.e. 1989 are used since the HSS survey does not exist for 1990.
[6] In our sample, there is no information on when the household bought the residence. We assume that the residents have lived in the same house for at least 3-4 years.

Tenure choice Estimation

Housing price changes may be regarded as capital gains by homeowners. However, housing price increases may also have an effect on the savings behavior of renters, because renters often save money with the hope of becoming a homeowner someday. Unexpected housing price increases mean that renters need to save more. In order to compare the effect of housing price increases on homeowners and renters, we estimate the savings functions for each group separately.

As suggested by Krumm & Kelly (1989), we consider the decisions of household tenure choice and savings as being interrelated. In other words, tenure choice is endogenous. If we directly estimate the savings function according to the current tenure status of the household, the estimation results will be biased. To manage the problem of endogeneity, the two-stage procedure for correcting sample selection bias developed by Heckman (1979) is used. In the first stage, a housing tenure choice model is estimated. Since housing tenure choice is a binary choice, and assuming the error term is normally distributed, we use a probit model to estimate it. A l is obtained[7] from the tenure choice model and included as an explanatory variable in the savings function in the second step. The model specification and the results of the tenure choice estimation are presented in Appendix 2.

Estimation of the Savings Function

To accommodate the nature of the SFIE data, in this research savings is defined as the residual between income and expenditure in the survey year. Under this definition of savings, if a household responds to house price increases by increasing consumption or non-consumption expenditure, its savings will be smaller; this is in conformity with the theoretical derivation of the previous section. Specifically, the savings function of homeowners and renters is specified as Equation (6):

$$SAVR_i = c_0 + c_1 INC_i + c_2 KGR_i + \sum_{k=1}^{5} c_{3,k} DAGE_i + \sum_{k=1}^{2} c_{4,k} DMA_i + c_5 FMSZ_i + \sum_{k=1}^{2} c_{6,k} DEDU_i + c_7 l_i \quad (6)$$

[7] l = PDF / CDF for homeowners and l =PDF/(1-CDF) for renters.

The variables in Equation (6) are defined as follows:

Table 1: Definition and Expected Sign of the Variables

Variable	Expected Sign	Definition
SAVR		Savings/income where Savings = Disposable income – Consumption expenditure – Non-consumption expenditure
INC	+	Disposable income
KGR(model 1)	- +	KGR= IHP / housing price of year 1[8]
KGYR(model 2)	-+	KGYR=IHP/income where IHP is one year of house price increases (averaged from 3- 4 years of price increases)
DAGE1	?	Age of household head, 1 = less than 25, 0 = otherwise
DAGE2	?	Age of household head, 1 = between 25 and 35, 0 = otherwise
DAGE3	?	Age of household head, 1 = between 35 and 45, 0 = otherwise
DAGE4	?	Age of household head, 1 = between 45 and 55, 0 = otherwise
DAGE5	?	Age of household head, 1 = between 55 and 65, 0 = otherwise
DMA1	?	Marital status of household head, 1 = married, 0 = otherwise
DMA2	?	Marital status of household head, 1 = never married, 0 = otherwise
FMSZ	-	Family Size, number of household members
DEDU1	?	Education of household head, 1 = elementary school, 0 = otherwise
DEDU2	?	Education of household head, 1 = high school, 0 = otherwise
?	-	Adjustment term of tenure choice estimation

Dependent variable SAVR is defined as the savings ratio in terms of income. Housing price changes are defined in two ways. In Model 1, they are defined as the ratio of price changes over the household's own housing price, and in Model 2 they are defined as the ratio of price change over income. From these two specifications, we can compare the ways households react to housing price increases.[9]

[8] Year 1 represents 1982, 1986, and 1989.

[9] The log-linear function is another choice for the functional form. However, the log cannot be taken with negative housing price increases, and this is a serious problem for the 1985 sample, in which more than half of households show negative housing price increases.

The Results of the Empirical Analysis

Sample characteristics

In order to compare the characteristics of homeowners and renters in our sample, the mean and standard deviation of the relevant variables are listed in Table 2 and Table 3. From these two tables, it can be seen that income grew sharply for both homeowners and renters, and that homeowners' income increase was greater than that of renters. Overall, housing prices decreased slightly in 1985 but increased by around 40% in 1989 and by more than 10% in 1993. The percentage of housing price increase is found to be higher for renters than for owners, whether in terms of housing price or in terms of income.

As to the age of the household head, we find that, overall, renters were younger than homeowners in 1985 and 1989, and that by 1993, the age difference between these two groups had narrowed. This change may be due to the growth of Taiwan's aged population; however, it may also be due to the postponement of house purchases because of high housing prices.

Considering the marital status of the household head, the proportion of married homeowners exceeded that of married renters. For family size, it is found that homeowners have a larger family than renters; a downsizing trend can also be found in the overall population. As regards the educational level of the household head, the homeowner sample has a higher proportion of households with a college or higher education; the proportion with an elementary level education was also higher among homeowners than among renters. Contrarily, the renter sample shows a higher proportion of households with a high school education.

Table 2: Mean and Standard Deviation for the Years 1985, 1989 and 1993 (The Owner Sample)

	1985		1989		1993	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Savings	76,797	124,654	131,780	215,720	229,399	333,661
Savings ratio	0.1583	0.3071	0.1951	0.2609	0.2099	0.2904
Income	373,518	227,174	543,113	341,561	865,759	526,126
Housing price	1,200,990	2,219,185	2,608,233	2,274,894	3,939,314	2,722,782
Increase of housing price (IHP)	-5,703	549,019	441,131	308,482	200,909	196,559
IHP / Housing price (KGR)	-0.0056	0.1154	0.385	0.1727	0.0806	0.0552
IHP / Income (KGYR)	-0.0203	0.7165	0.9951	0.7199	0.3135	0.4220
Age of household head						
<25	0.0075	0.0861	0.0087	0.0927	0.0079	0.0883
25~35	0.1808	0.3849	0.1654	0.3715	0.1336	0.3403
35~45	0.2486	0.4322	0.2747	0.4464	0.2966	0.4568
45~55	0.2441	0.4296	0.2158	0.4114	0.2057	0.4042
55~65	0.2047	0.4035	0.1981	0.3986	0.1898	0.3921
>65	0.1143	0.3182	0.1372	0.3441	0.1664	0.3725
Marital status of household head						
Married			0.8384	0.3681	0.8208	0.3835
Never married			0.0376	0.1903	0.0414	0.1992
Divorced or widowed			0.1240	0.3296	0.1378	0.3447
Family size	3.7342	1.8927	3.3720	1.7499	3.2062	1.6974
Education level of household head						
Elementary school	0.6079	0.4882	0.5530	0.4972	0.4960	0.5000
High school	0.2659	0.4418	0.3120	0.4633	0.3387	0.4733
College or higher	0.1262	0.3320	0.1350	0.3418	0.1652	0.3714

Source: Calculated from the original data tape of the "Survey of Family Income and Expenditure in the Taiwan Area of the Republic of China", conducted by DGBAS, Executive Yuan, 1985, 1989 and 1993.

Table 3: Mean and Standard Deviation for the Years 1985, 1989 and 1993 (The Renter Sample)

	1985		1989		1993	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Savings (NT$)	56,043	83,094	103,679	145,24	187,730	270,922
Savings ratio	0.1522	0.2239	0.1919	0.3539	0.2318	0.2257
Income (NT$)	304,016	165,655	443,364	257,803	680,745	432,040
Housing price (NT$)	859,471	536,910	2,423,613	1,810,808	3,258,978	1,940,959
Increase of housing price (IHP)	-34,786	247,498	375,834	269,605	208,841	144,964
IHP / Housing price (KGR)	-0.0255	0.0512	0.4146	0.1961	0.1001	0.0571
IHP / Income (KGYR)	-0.1253	0.6815	1.0376	0.8165	0.4070	0.3849
Age of household head						
<25	0.0227	0.1489	0.0116	0.1072	0.0183	0.1339
25~35	0.3609	0.4803	0.3128	0.4637	0.2274	0.4192
35~45	0.2606	0.4390	0.3002	0.4584	0.3398	0.4737
45~55	0.1394	0.3465	0.1401	0.3471	0.1307	0.3371
55~65	0.1376	0.3445	0.1262	0.3321	0.1003	0.3004
>65	0.0789	0.2696	0.1091	0.3118	0.1837	0.3873
Marital status of household head						
Married			0.7556	0.4298	0.7143	0.4518
Never married			0.0972	0.2962	0.1024	0.3032
Divorced or widowed			0.1472	0.3544	0.1833	0.3870
Family size	3.0394	1.5418	2.8141	1.4601	2.6506	1.4054
Education level of household head						
Elementary school	0.5093	0.5000	0.4629	0.4987	0.4121	0.4923
High school	0.3720	0.4834	0.4038	0.4907	0.4461	0.4972
College or higher	0.1186	0.3234	0.1333	0.3400	0.1418	0.3489

Source: Calculated from the original data tape of the "Survey of Family Income and Expenditure in the Taiwan Area of the Republic of China", conducted by DGBAS, Executive Yuan, 1985, 1989 and 1993.

Regression results for the homeowner sample

The regression[10] results for the homeowner sample for the years 1985, 1989 and 1993 (Equation (6)) are presented in Table 4[11]. From the Table, it can be seen that the coefficients of all the variables, except KGR and KGYR, are almost identical for the two models of each year. The coefficients for income imply that the income elasticities are 0.86, 0.86 and 0.48, 0.55 and 0.61, 0.65, respectively, for the two models of 1985, 1989 and 1993. We find that the effect of the income to savings ratio was smallest in 1989, which is the year when housing price increases were highest.

The effect of housing capital gains on the savings ratio has different signs in the two models. In Model 1, the coefficient for 1985 has a negative sign, while the coefficients for 1989 and 1993 are positive. However, in Model 2, the coefficients have a negative sign for all three years. The negative coefficients in Model 2 indicate that households respond to the wealth effect from housing price increases when such increases are measured relative to income. This result implies that the life-cycle hypothesis is valid. The effect was strongest in 1989, indicating that households may have illusions about increases in their wealth; hence, they not only respond to capital gains per se, but also to the amount of capital gains[12].

In the 1989 and 1993 samples, it is interesting to note that the coefficients of KGR and KGYR have opposite signs. This indicates that the correlation between KGR and KGYR is quite low in the sample. Those with a high KGR differ from those with a high KGYR. For those with a high KGR, the savings ratio increases; for those with a high KGYR, however, the savings ratio decreases. These differences may stem from different behavior motives. House price increases with respect to the price of the house itself seem to cause households concern for themselves or their heirs as regards the future housing price, hence, an increased savings ratio. However, house price increases with respect to income seem to cause the wealth effect and a decreased savings ratio. Considering the complexity of the households' reaction, the overall effect of house price changes on the aggregate savings ratio becomes impossible to determine exactly.

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[10] The LIMDEP statistical package is used in conducting the statistical analysis.

[11] Considering the possible existence of measuring errors derived from estimating housing price increases, the procedure suggested by White (1980) for the heteroskedasticity-consistent covariance matrix is applied.

[12] The Taiwan stock market also reached a high point in late 1989. Households conceivably also respond to capital gains from stock market activity.

Table 4: Savings Regression Function - The Owner Sample

Variables	1985				1989				1993			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	Coefficient	P[|Z| > z]	Coefficient	P[|Z| > z]	Coefficient	P[|Z| > z]	Coefficient	P[|Z| > z]	Coefficient	P[|Z| > z]	Coefficient	P[|Z| > z]
Intercept	0.0843	0.00	0.0809	0.00	0.1958	0.24	0.2828	0.00	0.2570	0.00	0.2828	0.00
Income (NT$)	3.6499E-07	0.00	3.6525E-07								1.9713E-07	0.00
	1.7186E-07	0.00	1.5665E-07	0.00	1.4795E-07						0.00	
Increase of housing price /housing price (KGR)	-0.426	0.01			0.1254	0.00			0.2292	000		
Increase of housing price / Income (KGYR)			-0.0156	0.00			-0.0835		0.00		-0.0744	
			0.11									
Age of household head												
<25	0.1050	0.00	0.1028	0.00	0.1238	0.00	-0.0079			0.83	0.1314	0.00
	0.1023	0.00										
25~35	0.0456	0.00	0.0438	0.00	0.1167	0.00	0.0291				0.0924	0.00
	0.0781	0.00									0.05	
35~45	0.0100	0.24	0.0091	0.29	0.0682	0.00	0.0059			0.60	0.0363	0.00
	0.0498	0.02										
45~55	0.0177	0 15	0.0117	0.15	0.0412	0.00	0.0013			0.90	0.0195	0.02
	0.0384	0.28										
55~65	0.0180	0.11	0.0187	0.10	0.0374	0.00	0.0169			0.05	0.0378	0.00
	0.0287	0.00										
Marital status of household head												
Married					-0.0353	0.00	-0.0178				0.06	
-0.0618	0.00	-0.0579			0.00							
Never married					0.1359	0.00	0.1131	0.00	0.0842	0.00		

As for the effect of the age of the household head, Table 4 shows that the coefficients for all age groups of all three years are positive. This indicates that the over-65 age group, which is the contrast group, has the lowest savings ratio among all age groups. This finding is consistent with that tenet of the life-cycle hypothesis which holds that people dissave in their old age. We can also see that the younger age groups had a higher savings ratio for all 1985, 1989 and 1993. Marital status is also seen to affect savings significantly. The contrast group consists of individuals who are either widowed or divorced. From Table 4, it can be seen that the "never married" group has the highest savings ratio among the three groups, and that the "married" group has the lowest. This is probably because married households feel more secure financially, and hence save less.

As for the effect of the education level of the household head, we find that the higher the education level of the household head, the lower the savings ratio. This is likely due to the fact that for the higher educated, the flow of income is more stable; hence, the need for precautionary saving is reduced.

For the sample selection bias correction term, ?, we find that the coefficients are negative and statistically significant in all three years. This result is also consistent with our expectation that tenure choice and savings are inter-correlated.

The regression results for the renter sample

The regression results for the renter sample are presented in Table 5. The coefficients for income imply that the income elasticities for the savings ratio are 0.94, 0.94 and 0.81, 0.65 and 0.64, 0.49, respectively, for the two models of 1985, 1989 and 1993. These figures show that renters had a slightly higher income elasticity with respect to the savings ratio than owners. This is probably because renters have a strong motive to save, that is, in order to purchase a house. We also find that renters' income elasticity declines as income increases over the years.

The effect of housing price increases on the savings ratio for renters is quite different from that for owners. For Model 1, the coefficient is negative and statistically significant for the 1985 sample, but is positive and not significant for the 1989 and 1993 samples. For Model 2, the coefficient is positive for the 1985 sample, but negative for the 1989 and 1993 samples; and all three coefficients are significantly different from zero. In the 1985 and 1989 samples, the coefficients of KGR and KGYR have different signs. The negative signs of KGYR in 1989 and 1993 indicate the existence of

Table 5: Savings Regression Function - The Renter Sample

Variables	1985				1989				1993			
	Model 1		Model 2		Model 1		Model 2		Model 1		Model 2	
	Coefficient	P[|Z| > z]	Coefficient	P[|Z| > z]	Coefficient	P[|Z| > z]	Coefficient	P[|Z| > z]	Coefficient	P[|Z| > z]	Coefficient	P[|Z| > z]
Intercept	0.0692	0.00	0.0739	0.00	0.0368	0.24	0.1767	0.01	0.114	0.00	0.2358	0.00
Income (NT$)	4.7099E-07	0.00	4.7046E-07								3.5140E-07	0.00
	2.7899E-07	0.00	2.1916E-07	0.00	1.6795E-07						0.00	
Increase of housing price /housing price (KGR)	-0.1944	0.00			0.0070	0.73			-0.0753	0.30		
Increase of housing price / Income (KGYR)			0.0050	0.06			-0.0714			0.03		-0.1731
			0.00									
Age of household head												
<25	0.0322	0.23	0.0324	0.23	-0.0356	0.53	-0.0547			0.35		-0.0543
	-0.0621	0.02									0.04	
25~35	-0.0130	0.33	-0.0127	0.34	0.0387	0.03	0.0290					0.13
	-0.0557	0.00									-0.0395	0.01
35~45	-0.0247	0.11	-0.0241	0.12	-0.0017	0.95	-0.0057			0.83		-0.0373
	-0.0498	0.00									0.01	
45~55	-0.0185	0.21	-0.0170	0.24	0.0199	0.34	0.0119			0.57		-0.0174
	-0.0384	0.01									0.25	
55~65	0.0033	0.82	0.0039	0.79	0.0012	0.95	-0.0054			0.81		-0.0044
	-0.0287	0.07									0.78	
Marital status of household head												
Married					0.0078	0.69	-0.0101					0.69
					0.37						0.0237	0.09
	0.0109											
Never married					0.0729	0.00	0.0800	0.00	0.0887	0.00		

despair consumption as a result of the skyrocketing house prices relative to income in Taiwan in 1989 and 1993. Housing prices increased 104% and 41% relative to income in these two years, respectively.

Contrary to the homeowner sample, the age of the household head does not have a significant effect on the saving behavior of households for most age categories. This suggests that the life-cycle effect for renters is not as obvious as for homeowners.

“Never married households”, however, as in the homeowner sample, have the highest savings ratio among the different categories of marital status, other things being equal.

As for the education level of the household head, we find that the results are also similar to those for the homeowner sample, i.e., household heads with a college level education have the lowest savings among the various groups.

As for the coefficients for the sample selection bias correction term, ?, the results indicate that tenure choice was an important influencing factor in the saving behavior of renters in the 1985 sample.

Conclusion

The purpose of this research is to empirically test whether house price increases are an important factor in a household’s savings decisions and whether or not housing tenure choice and savings behavior are intercorrelated.
Original household data from the “Household Income and Expenditure Survey”, conducted by the Taiwan government, is used to econometrically estimate the savings function for homeowners and renters in Taiwan. Survey data for 1985, 1989 and 1993 are used to estimate and compare households’ saving behavior at different times.

The empirical results show that in certain cases the coefficients of the two different definitions of house price increases have opposite signs. This is a very interesting phenomenon. These differences may stem from different behavior motives. House price increases with respect to the price of the house itself seem to cause households concern over future housing prices; this explains households' increased savings ratio. However, house price increases with respect to income would seem to cause the wealth effect and consequently a decreased savings ratio. Considering the complexity of households' reaction, the overall effect of house price changes on the aggregate savings ratio becomes impossible to precisely determine. More

research on this topic using other data sources is necessary before one can really be sure that the findings of the present paper are valid.

From the regression results, we may also discern the profound influence of sharp housing price increases in the late 1980s in Taiwan. At that time, overall, housing prices in Taiwan more than doubled. For the owner sample, it is found that income elasticity for the savings ratio was lowest in 1989, and that the effect of KGYR on savings was also strongest in 1989. For the renter sample, meanwhile, despair consumption is evident in the years 1989 and 1993.

Acknowledgement

I thank National Science Council for providing research grant. (Project no. NSC-87-2415-H-170-002)

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Appendix 1: Hedonic Regression for Housing Price

Variable		1982	1985	1986	1989	1993
Intercept	Coefficients	2.5342	2.5665	3.1033	3.7415	4.1866
	p-value	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Dwelling only	Coefficients	-0.4416	-0.3414	-0.3447	-0.3528	-0.3564
	p-value	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Brick construction	Coefficients	1.1027	0.9805	0.6955	0.9411	0.9159
	p-value	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Reinforced Concrete construction	Coefficients	1.3089	1.1225	0.7898	0.9969	1.0560
	p-value	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Apartment less than 5 floors	Coefficients	0.3660	0.3554	0.4046	0.1184	0.0791
	p-value	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Apartment more than 6 floors	Coefficients	0.6466	0.5311	0.7689	0.5006	0.3260
	p-value	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Number of rooms	Coefficients	0.2038	0.1008	0.0393	0.0751	0.0555
	p-value	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Area of dwelling	Coefficients	0.0054	0.0195	0.0194	0.0159	0.0142
	p-value	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Taipei City	Coefficients	0.4872	0.3551	0.2279	0.8695	0.8005
	p-value	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Kaohsiug City	Coefficients	0.4638	0.2156	0.0321	-0.0425	-0.0079
	p-value	(0.0001)	(0.0001)	(0.2479)	(0.1118)	(0.7697)
Taichung City	Coefficients	0.6126	0.3688	0.3806	0.2188	0.3163
	p-value	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Taipei County	Coefficients	0.1152	0.0732	0.0043	0.1748	0.5648
	p-value	(0.0002)	(0.0023)	(0.8634)	(0.0001)	(0.0001)

Appendix 2: Results of the PROBIT Regression for Tenure Choice

Variable	1985		1989		1993	
	Coefficients	P-value	Coefficients	P-value	Coefficients	P-value
Intercept	-0.3623	0.0001	-0.2362	0.0227	-0.2238	0.0334
Income	1.46E-06	0.0001	9.11E-07	0.0001	5.41E-07	0.0001
Age of household head	0.0275	0.0001	0.0255	0.0001	0.0263	0.0001
Family size	0.0550	0.0001	0.0281	0.0067	0.0202	0.0530
Sex	-0.0544	0.1939	-0.0313	0.4681	0.0143	0.7200
Education of household head						
Elementary school	-0.2545	0.0001	-0.2524	0.0001	-0.3021	0.0001
High school	-0.2417	0.0001	-0.2061	0.0001	-0.2880	0.0001
Marital status of household head						
Married			0.1982	0.0001	0.1872	0.0001
Never married			-0.0293	0.6884	0.0273	0.7033
Working status of household head						
Employer or self-employed	0.0781	0.1033	-0.0701	0.1400	-0.0177	0.7070
Employee	0.0711	0.1261	0.0063	0.8913	0.1279	0.0043
Location						
Taipei City	-0.7493	0.0001	-0.6372	0.0001	-0.6474	0.0001
Taipei County	-0.3877	0.0001	-0.4695	0.0001	-0.4165	0.0001
Taichung City	-0.5042	0.0001	-0.5342	0.0001	-0.5706	0.0001
Kaohsiung City	-0.5553	0.0001	-0.5117	0.0001	-0.3571	0.0001
Sample size	13294		13648		15188	
Log Likelihood for NORMAL	-5370.47		-5265.83		-4792.39	