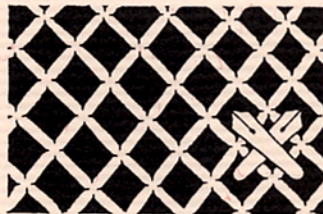


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Current Wealth, Housing Purchase
and
Private Housing Loan Demand
in Japan

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Abstract

Japanese households accumulate a large amount of wealth for a downpayment; thus current wealth plays an important role in a home acquisition. Public loans through direct mortgage lending also provide strong support for a home purchaser. We estimated the wealth effect on private mortgage debt and housing consumption (house value) by applying a model which posits that a mortgage debt demand is derived from house purchase decision in conjunction with housing consumption. We used a simultaneous equation Tobit estimation method. Wealth effects on private mortgage debt, the likelihood of borrowing, and on house value are not elastic; house value effect on mortgage borrowing, however, is elastic.

1 Introduction

The Japanese households accumulate wealth at a very high rate, mainly because people have strong incentives to own their houses; thus they accumulate wealth for the downpayment. The downpayment for a housing purchase ranges on average from 30% to 50%.¹ of house value. Twenty percent of the downpayment is accounted for by accumulated wealth, while with the rest is from transferred wealth (gifts and inheritance) and the sale of a previous home. For these reasons, it is likely that wealth accumulation has a significant effect on the Japanese mortgage and housing markets.

In recent years, though there has been a large number of studies on home mortgage choice, few have explored the determinants of the demand for home mortgage debt, despite the large size of the mortgage market. Most of these studies focus on the relationship

¹ The former shows the percentage in the case of purchasing a spec house or condominium, while the latter exhibits that of purchasing a custom-made house.

these reasons, it is likely that wealth accumulation has a strong impact on the Japanese mortgage and housing markets.

Although there has been a large number of studies on home mortgage choice in recent years, few analyses have explored the determinants of demand for home mortgage debt despite the large size of the mortgage market. Most of these studies deal with the relationship between wealth and home mortgage debt. Some utilize an optimal portfolio choice framework; others do not. These studies emphasize the role of wealth in determining home purchases as well as household debt. However, there is no consensus about the wealth effect on mortgage debt demand; thus additional empirical evidence is needed.

King and Leape (1984) estimate a home mortgage debt demand function employing an incomplete portfolio model and find that the wealth elasticity of home mortgage debt demand is less than unity. They also report that mortgage debt demand is negatively related to nonhousing wealth, which includes only riskless assets, but positively related to riskier bonds. Ioannides (1989), investigating the role of housing in wealth portfolios, finds a negative relationship between mortgage debt and financial wealth. Brueckner (1994), who does not employ a portfolio choice framework but uses a consumer's two period utility maximization model, theoretically finds a negative relationship between them. On the other hand, Duca and Rosenthal (1993), who do not employ the portfolio choice model either, find a significant positive impact of net wealth on debt demand using total debt and full net wealth variables. Jones (1994,1995), exploring the idea that optimal debt position should be analyzed in the framework of portfolio choice models, estimates the demand for mortgage borrowing to satisfy nonhousing portfolio objectives. Focusing on the demand for excess mortgage debt rather than total mortgage borrowing in order to evaluate the impact of net nonhousing wealth on the demand for mortgage debt, he finds that the impact of nonhousing wealth on excess mortgage debt is negative. Manchester and Poterba (1989), however, also obtain a negative relationship for second mortgage borrowing. Jones concludes that mortgage debt is used to attain a desired

portfolio allocation, while obtaining the same negative relationship; however, Manchester and Poterba conclude that mortgage debt is financed for consumption objectives.

The above empirical results come from a housing finance market which is not segmented into public and private sectors. In Japan the role of the public sector in the mortgage market is much more important. The Japanese mortgage market² is segmented into the Public Corporations' (PCs) sector and the private sector, the government controlling the former. PCs provide mortgage loans on easier terms, especially with respect to downpayment constraints. For instance, the Government Housing Loan Corporation (GHLIC), which is the largest PC, has not imposed downpayment constraints except in 1996. Before the 1970s it was difficult for a household to borrow from the private sector. At that time, PCs played a much more important role in households' home purchases. Currently, mortgage borrowing is a popular instrument for home acquisition; however PCs still have a large share in the mortgage market.

Mortgage borrowing is collateralized by principal residences. However, it is reasonable to assume that Japanese households usually do not use mortgage borrowing for consumption or portfolio objectives because PCs are prohibited from financing objectives other than housing purchases. It is recognized that funds are fungible, therefore, households may borrow more than they need for the housing purchase and use this excess debt for consumption or investment purchases. A household can borrow from a PC at a fixed rate over a very long repayment period (more than thirty years), but even if it wants to repay, it must make a one-time total repayments.³ Thus, bearing in mind the risk involved, holding debt for a long time is not cheap, and may even, in fact, be more costly. The saving interest rate is usually lower than the PC mortgage interest rate, therefore, it is not reasonable for a Japanese household to use mortgage borrowing for consumption or investment. Furthermore, since interest on mortgage payments cannot be deducted from

² The features of the Japanese mortgage market are described in detail in Moriizumi (1996).

³ This system was changed in 1996. A household must pay an agency cost every time it repays debt.

taxable income, there are no incentives for purchasers to use mortgage borrowing for another purpose. Similarly, as exhibited in Figure I, the private mortgage interest rate is much higher than the saving interest rate, so it is not rational to use private mortgage borrowing for other objectives. In this sense, the mortgage and consumer loan markets are segmented from other capital markets. Thus, a portfolio choice framework is not particularly effective in analyzing the relationship between mortgage debt demand and wealth. Accordingly, the demand for mortgage debt can be assumed to be derived from the demand for housing.

Generally, a change in wealth has two conflicting effects on mortgage debt. First, an increase in current wealth raises housing demand, which in turn increases demand for mortgage debt. Second, conditional upon the decision to purchase a house and its quantity, an increase in current wealth decreases or increases the demand for mortgage debt depending upon the degree of household risk aversion. The former (denoted as an unconditional effect) relates to preference for housing consumption as well as holding debt, while the latter (denoted as a conditional effect) relates to household preferences for holding debt, which reflects household attitudes toward risk. In the mortgage debt context we need to distinguish conditional from unconditional effects. Otherwise the effect of wealth on the mortgage market will be biased due to the mixture of these two effects. To separate conditional from unconditional effects of wealth on mortgage debt, a simultaneous estimation of housing purchase and mortgage debt demand is needed, and the conditional distribution must be derived. Furthermore, since there are necessarily borrowers and non-borrowers in the mortgage market, we have to avoid selectivity bias as caused by the sample of non-borrowers. Therefore, a simultaneous equation model with censoring is needed.

However previous studies have estimated the wealth effect without taking account of simultaneity, selectivity and conditional inference. In order to estimate the conditional wealth effect separately while taking into consideration the selectivity bias, this study

constructs a model where households have predetermined homeownership and where the quantity of housing purchased and home mortgage debt demand are estimated jointly by employing the simultaneous Tobit model on micro data. The conditional wealth effect is estimated by using conditional distribution.

The paper is structured as follows. Section 2 provides a testable simultaneous model for mortgage demand and the quantity of housing purchased. Section 3 discusses the estimation method and the inference from the conditional distribution. Data and variable definitions are given in Section 4. Section 5 contains the estimation results and elasticity comparisons. Concluding remarks are noted in Section 6. Estimation results for the instrument variables are provided in the Appendix.

2 An Empirical Model for Japanese mortgage debt demand

Mortgage borrowing may be used to finance consumption or investment in non-housing assets in other countries (Jones 1995). However, as mentioned in the introduction, Japanese households usually do not use mortgage borrowing to finance other objectives at the time of house purchase. Thus, the demand for mortgage debt can be assumed to be derived from the demand for owner-occupied housing services. Household mortgage debt demand is derived from a housing purchase decision adapting Brueckner's model, where the mortgage debt amount is determined jointly with house value and the amount of saving (consumption).

The Japanese mortgage market is segmented into the Public Corporations'(PCs) sector and the private sector, where the former provides mortgage loans at a lower mortgage interest rate and easier terms but mortgage amounts are more limited. It is financially rational for a household to first borrow from a Public Corporation and then from the private sector if it cannot raise enough funds. ⁴

⁴ Some households can borrow from their firms with easier terms and sometimes lower interest rates

We introduce two mortgage markets into Brueckner's two-period model, where a household maximizes the sum of its current-period and future utilities subject to a household's current and future budget constraints and liquidity constraints as well as other constraints related to the mortgage market.

Defining the current wealth w as the sum of current income and assets, a household allocates this wealth into nonhousing consumption c , the purchase of a house, and saving at the time of home purchase, taking into consideration various kinds of constraints. Given the credit limit of PC loans $\bar{m}_1$, the mortgage debt amounts of both PCs (m_1) and the private sector (m_2), the value of the house H and the amount of saving s are determined simultaneously in a two-period framework. Furthermore saving is assumed to be composed of precautionary savings⁵ $\bar{s}$ and other savings s ; the former is assumed to be predeterminately constant.

Denoting the current-period utility function $U(c, h)$, where $c = w - s - (ph - m_1 - m_2)$, p is the purchase price per unit of housing, and h is the housing consumption which is produced from housing stock (h_s) at a constant flow rate τ . It is assumed that $U(c, h)$ is separable; $U(c, h) = G(c) + F(h)$.

Future wealth z can be written as : $z = y + (1 + r_s)s + ph - (1 + r_1)m_1 - (1 + r_2)m_2$, and the level of z determines future utility $V(z)$, where y is future income, r_s is the interest rate earned on saving, r_1 is the mortgage interest rate of PC loans and r_2 is that of the private sector.⁶

Giving the discounted value of future utility by $\delta V(z)$, where δ is a discount factor, a household maximizes its lifetime utility, $U(c, h) + \delta V(z)$, subject to the following

than PC loans. However, not all firms have this system and not all workers at those firms are eligible, because it applies several criteria, for instance, length of employment. So, a household first borrows from its firm if possible, secondly from a PC, thirdly from the private sector and/or from relatives or friends. We would have liked to introduce borrowing from firms, but detailed data is unavailable.

⁵ This represents savings for unexpected expenses, including illness and living costs after retirement, etc.

⁶ Brueckner analyzes cases where r_s is both stochastic and nonstochastic; however, in our model r_s is assumed to be nonstochastic.

constraints:

$$c = w - s - (ph - m_1 - m_2) \quad (1)$$

$$z = y + (1 + r_s)s + ph - (1 + r_1)m_1 - (1 + r_2)m_2 \quad (2)$$

$$s' \geq 0 \quad (3)$$

$$m_1 \leq \bar{m}_1 \quad (4)$$

$$m = m_1 + m_2 \leq \kappa ph \quad (5)$$

$$m_1 \geq 0, \quad m_2 \geq 0 \quad (6)$$

where m represents the total amount of mortgage debt demand and κ denotes the maximum mortgage loan-to-value (LTV) ratio ($\kappa < 1$). Equation (1) is the current period budget constraint, (2) is the future wealth constraint, and (3) is the liquidity constraint. Equation (4) indicates that PC loan demand cannot exceed its limit and (5) shows the borrowing constraint.

Substituting c and z into U and V , the optimization problem is to choose h , s , $m(m_1, m_2)$ to maximize $U + \delta V$. There are a number of solutions in the above model. However, following Brueckner we can derive the relationship among multipliers and can rule out a number of cases.

Before discussing the Japanese case, it will be instructive to describe the treatment of taxes in Japan. A special tax credit for housing loan repayments is available for 1 % of the amount of the debt, not exceeding 20 million yen, for households which borrow funds from public or private financial institutions based on a loan contract in which repayments are made by installment over 10 years or more. At most, 0.2 million yen may be deducted from the income tax amount. This tax credit can only be claimed for the first five years. There are a number of eligibility restrictions, e.g., household income, the size of the house, etc. Therefore, this is a very small amount compared to the period of amortization: 35 years for GHLC, less for the private sector.

Interest earned on savings is usually taxed at 20%. Exemption from this is not widespread and is applied to small deposits and government bonds for the elderly and other special persons.⁷ Because of this credit, $r_s < r_2$ (after tax) always holds. As for the PC mortgage interest rate, this is usually $r_1 > r_s$, but occasionally, $r_1 = r_s$.⁸

Focusing on the Japanese case where $r_s \leq r_1$, $r_s < r_2$, $r_1 < r_2$ and letting λ , μ_1 , μ_2 , θ_1 , θ_2 denote the respective multipliers associated with the above constraints (3)-(6), the following three inequalities must be satisfied.

$$\lambda \geq \mu_1 + \mu_2 - \theta_1, \quad \lambda > \mu_2 - \theta_2, \quad \mu_1 > \theta_1 - \theta_2. \quad (7)$$

There are two optimal cases for mortgage debt demand in private sector; $m_2 > 0$ and $m_2 = 0$. $m_2 > 0$ is compatible with (1) $s = 0$,⁹ $m_1 = \bar{m}_1$, $m_2 = \kappa ph - \bar{m}_1$, $m = \kappa ph$, (2) $s = 0$, $m_1 = \bar{m}_1$, $m_2 < \kappa ph$, $m < \kappa ph$. These solutions mean that a household does not borrow from the private sector unless it borrows from PCs up to its limit, which is consistent with observed practice. On the other hand, $m_2 = 0$ is compatible with (1) $s = 0$, $m_1 = \bar{m}_1 \leq \kappa ph$, (2) $s = 0$, $m_1 < \bar{m}_1 < \kappa ph$, (3) $s > 0$, $0 < m_1 < \kappa ph$ and (4) $s > 0$, $m_1 = 0$, which means that if a household has a large downpayment or can obtain enough funds in the PC loan market, it will not borrow from the private sector.

Given the separability of the current period utility function, if $m_2 > 0$, m_2 is determined as a function of h, w , and y as well as other exogenous variables whereas h is derived only from exogenous variables. Distinguishing m_2 (actual) from m_2^* (potential), the following simultaneous equations model with error terms u , u' and u_2 is presented.

$$m_{2i} = \begin{cases} m_{2i}^* = m_2(\bar{m}_{1i}, w_i, h_i, \mathbf{x}_{1i}) + u_i & \text{iff } m_{2i}^* > 0 \\ 0 & \text{otherwise.} \end{cases} \quad (8-1)$$

$$\bar{m}_{1i} = \bar{m}_1(\mathbf{x}'_{1i}) + u'_i \quad (8-2)$$

$$h_i = h(w_i, \mathbf{x}_{2i}) + u_{2i} \quad (8-3)$$

⁷ Interest income from savings was tax exempt prior to April 1, 1988.

⁸ If a households are special one whose interest incomes are tax exempt, it could be occasionaly possible that r_s nearly equals to r_1 .

⁹ Saving equals to precautionary saving.

where i represents i th observation and $\mathbf{x}_1, \mathbf{x}'_1, \mathbf{x}_2$ are exogenous variables (vector) related to $m_2(m^*2)$, $\bar{m}_1$ and h .

2.1 Estimation method and Conditional inference

Since there are both borrowers and non-borrowers in our model, we use the Tobit estimation method in order to avoid selectivity bias. Therefore, taking into consideration the endogeneity of house value as well as the censored sample, we assume the Tobit specification of the simultaneous equation.

Before coming to the estimation of the above model, a few remarks should be made concerning credit rationing in the Japanese mortgage market. Households whose payment-income ratio is more than 0.25 or 0.2, or who purchase a very small or very expensive house are rationed in PC loan market. Sometimes the GHLC does not impose the LTV (maximum loan-to-value) constraint.

On the other hand, private lenders usually impose both the LTV constraint and/or payment-income ratio constraint. However, in the case of excess supply in the private mortgage market, LTV constraints are very high; this was the case during our estimation period (1988-1989). Usually the LTV ratio is considered to be 0.8. However, most private lenders do not use the actual house price (market price) but use the assessed value as the house value, thus the LTV ratio is sometimes higher than 0.8. Private mortgage lenders sometimes provide funds up to the value of house to be purchased during these periods. Therefore, it is appropriate for us to check whether or not a household is rationed in the private mortgage market by using the PI constraint. Fortunately, we were able to obtain information on the PI constraint that private lenders imposed. From this information, during our estimation period, PI constraints range from 33 ~ 40 % depending upon a household's income. There are only 11 samples in our data which borrow from private lenders and face this constraint, so most households are considered to be unrationed in this respect.

As for the estimation of the $\bar{m}_1$ function, Moriizumi (1996), separating rationed from unrationed samples, uses the switching regression model with endogenous switching to estimate PC loan constraint function. However, the estimation of the above simultaneous Tobit equation requires the same sample size for each equation, so the sample needed to estimate equation (8-2) is the whole sample size. This means that equation (8-2) includes both rationed and unrationed samples; this does not express the constraint function but is a mixture of constraint and demand for PC loans (m_1). According to Moriizumi (1996), we cannot estimate the $\bar{m}_1$ function by using the data of households which are not rationed in the PC loan market; thus it is not desirable to estimate $\bar{m}_1$ separately, rather, it is better to substitute it into the m_2 function.¹⁰ In this paper, as we intend to analyze the wealth effect on private mortgage debt demand as well as on housing consumption, this is adequate for our objective.

Substituting $\bar{m}_1$ into m_2 function, the empirical model is described as follows:

$$m_{2i} = \begin{cases} m_{2i}^* = m_2(\mathbf{x}_{1i}, w_i, h_i) + u_{1i} & \text{iff } m_{2i}^* > 0 \\ 0 & \text{otherwise,} \end{cases}$$

$$h_i = h(w_i, \mathbf{x}_{2i}) + u_{2i}$$

$$\text{Corr}(u_1, u_2) = \rho_{12}, \quad (9)$$

where the error terms are correlated with each other, $\mathbf{x}_{1i}$ and $\mathbf{x}_{2i}$ are properly redefined, u_{1i} is a new residual¹¹ and ρ_{12} is a correlation coefficient. We assume that u_{1i} and u_{2i} have a bivariate normal distribution with mean vector zero and covariance matrix Σ . The model is the simultaneous equations Tobit model with one continuous (h) and one limited dependent variables (m_2) where error terms are correlated to each other.

Specifying the model linearly, and noting that housing consumption is a constant flow from housing stock h_s , $h = \tau h_s$ and furthermore H is used instead of h_s , the empirical

¹⁰ If we can separate explanatory variables $\mathbf{x}'_1$ in $\bar{m}_1$ from $\mathbf{x}_1$ and $\mathbf{x}_2$, we can estimate the $\bar{m}_1$ function by substitution. However, since some variables overlap, we cannot obtain the $\bar{m}_1$ function.

¹¹ We assume that u_{1i} is a linear combination of u_i and u'_i .

model used in this analysis is the following simultaneous equations Tobit model:

$$m_{2i} = \begin{cases} m_{2i}^* = \alpha' \mathbf{x}_{1i} + \beta w_i + \gamma H_i + v_{1i} & \text{iff } RHS > 0 \\ 0 & \text{otherwise,} \end{cases} \quad (10-1)$$

$$H_i = \pi w_i + \theta' \mathbf{x}_{2i} + v_{2i} \quad (10-2)$$

$$Corr(v_1, v_2) = \rho, \quad (10-3)$$

where α and θ are vectors of unknown parameters, ρ is a correlation coefficient, $Var(v_1) = \sigma_{11}$, $Cov(v_1, v_2) = \sigma_{12}$, and $Var(v_2) = \sigma_{22}$. The above simultaneous equations Tobit model is estimated by using the full information maximum likelihood method.

In the present context, exogenous variables in the m_2 Tobit equation would be current wealth w , future income y where we use estimated labor income y_l as a proxy, mortgage interest rates r_1, r_2 , saving interest rate r_s , variables for household characteristics, dummy variables for life cycle of household and variables related to $\bar{m}_1$. Similar to Brueckner (1994) and Jones (1993) models, optimal mortgage debt demand is determined by the relative magnitudes of the interest rate from saving r_s and the mortgage interest rate in our model, so the relative magnitudes of r_s and r_1 or r_2 , $(\frac{r_2}{r_s} - \frac{r_1}{r_s} = RATE21)$ are related in our mortgage debt demand function.

For $\bar{m}_1$, current income¹², job stability which represents repayment ability, household characteristics (age of household head, AGE), and other institutional factors, such as the size of house, area ($AREA$) and type of household would be important explanatory variables.

As for house value function, it includes current wealth as well estimated labour earnings y_l . In the context of the H equation, y_l is not a proxy for a future income, but an element of life cycle income. According to Jones (1990) we introduce both current wealth and labour income into the housing consumption equation. Other explanatory variables in the H regression equation would be price of housing stock $\hat{P}_H$ and dummy variables for life cycle of household.

¹² However, since introducing current income in the m_2 function has a multicollinearity problem caused by inclusion of both future and current incomes, we cannot introduce this variable into the equation.

This model permits us two types of inferences: conditional and unconditional. Given the quantity of housing purchase, the mean of the mortgage debt demand is expressed by the conditional mean. On the other hand, the unconditional mean exhibits the marginal mean of mortgage debt demand whatever the amount of housing purchased. In the mortgage debt demand context, debt demand is conditional on housing demand, so conditional inference is related.

We estimate the wealth effect on mortgage debt demand by using a conditional distribution. The conditional distribution of m_2^* given H is (suppressing i):

$$m_2^*|H = \alpha' \mathbf{x}_1 + \beta w + \gamma H + \frac{\sigma_{12}}{\sigma_{22}}(H - \pi w - \boldsymbol{\theta}' \mathbf{x}_2) + \varepsilon, \quad (11)$$

where ε is a random variable of a normal distribution with $Var(\varepsilon) = \sigma_{11} - \frac{\sigma_{12}^2}{\sigma_{22}}$.

From this we can make two kinds of inferences using the expected value of the above conditional distribution: the inference using all the observations including both zero and non-zero observations (both borrowers and non-borrowers), $E(m_2|H)$, and that using only use non-zero observations (borrowers), $E(m_2|H, m_2 > 0)$.

For all households including both borrowers and non-borrowers, the expectation function is:

$$\begin{aligned} E(m_2|H) &= \Phi(\cdot) \mathbf{z} \mathbf{x} + \sigma_\varepsilon \phi(\cdot) \\ \mathbf{z} \mathbf{x} &= \alpha \mathbf{x}_1 + \beta w + \gamma H + \frac{\sigma_{12}}{\sigma_{22}}(H - \pi w - \boldsymbol{\theta}' \mathbf{x}_2), \end{aligned} \quad (12)$$

and Φ and ϕ are, respectively, distribution and density functions of the standard normal, and $\Phi(\cdot) = \Phi(\frac{\mathbf{z} \mathbf{x}}{\sigma_\varepsilon})$, $\phi(\cdot) = \phi(\frac{\mathbf{z} \mathbf{x}}{\sigma_\varepsilon})$, where σ_ε is the standard deviation of ε . For borrowers, we can derive the following expectation function,

$$E(m_2|H, m_2 > 0) = \mathbf{z} \mathbf{x} + \sigma_\varepsilon \frac{\phi}{\Phi}. \quad (13)$$

A change in wealth affects both the likelihood of borrowing from the private sector and mortgage debt demand. First, we focus on the wealth effect of the likelihood of borrowing. Denoting η as elasticity, the conditional wealth elasticity of the probability of

borrowing from the private sector is: $\eta_w^\Phi = \frac{\beta w}{\sigma_\epsilon} \frac{\phi}{\Phi}$. The conditional wealth elasticity of the likelihood of borrowing exhibits the wealth effect on the probability of private mortgage borrowing, given H when wealth changes. In other words it shows, controlling for the value of the house, how many more households borrow from the private sector when their wealth decreases.

β represents a preference for holding debt depending on the household's attitude towards risk. The expected sign of β is ambiguous, depending upon the degree of household risk-aversion. This needs to be clarified by empirical studies. Wealth is often assumed to be inversely related to the degree of risk-aversion, so that β is expected to be positive. However, to the extent that households do not use mortgage borrowing for consumption or investment objectives, wealthier households have less need to borrow when they purchase houses, thus the expected sign of β is negative in this case. However, these assertions should be proved by empirical analysis.

Next, we focus on the impact of wealth on mortgage debt demand. A change in wealth on mortgage debt demand conditional upon H at the mean is expressed as $\frac{\partial E(m_2|H)}{\partial w} = \Phi\beta$ for all households, and $\frac{\partial E(m_2|H, m_2 > 0)}{\partial w} = \beta(1 - \frac{zx}{\sigma_\epsilon} \frac{\phi}{\Phi} - \frac{\phi^2}{\Phi^2})$ for borrowers. The conditional wealth elasticity of private debt demand $\eta_w^{E(m_2|H, m_2 > 0)}$ indicates to what extent the household allocates additional wealth to downpayment, controlling for the house value.

Similar to the wealth effect on the likelihood of borrowing, the expected sign of β is ambiguous and needs to be clarified in empirical studies. However as mentioned before, since Japanese households usually do not use mortgage borrowing to accomplish consumption or investment objectives, the mortgage market is separated from asset or consumer loan markets. Therefore wealthier households have less need to borrow when they purchase their houses. In this case, the sign on β is expected to be negative. This, however, should be tested by empirical analysis.

We are concerned with the conditional inference which can be derived from conditional distribution in equation (11). As mentioned above, the wealth effects of both likelihood of

borrowing and debt demand depend upon $\phi(\frac{ZX}{\sigma_\varepsilon})$, $\Phi(\frac{ZX}{\sigma_\varepsilon})$ and ZX , all of which relate to the distribution of the random variable in the conditional distribution (11). So far as the error term v_1 is correlated to v_2 , we cannot estimate the wealth effect by using equation (10-1) with an instrument variable method. The variance of the error term of the conditional distribution is $Var(\varepsilon) = \sigma_{11} - \frac{\sigma_{12}^2}{\sigma_{22}}$. Unless $\sigma_{12} = 0$ or $\rho = 0$, the wealth effect would be biased. Therefore we need to test the hypothesis that $\rho = 0$, which means testing the weak exogeneity of H .

3 Data and Variables

The household data used for this study are individual household data drawn from the Housing Survey on Condominiums in the Tokyo Metropolitan Area (HSC) during the period of 1988 -1989, conducted by the Urban Housing Corporation in cooperation with the Ministry of Construction. In this survey, some 800 households were surveyed concerning purchase price, date of purchase, size of house, and their financial situation as well as demographic characteristics at the time of the purchase. In order to obtain an appropriate sample size, two cross section samples were pooled from 1988 to 1989 (summer). In order to minimize the error of wealth prediction, we use samples of a first-time owner where the household head is under 60 years of age and those of non-credit rationed in private mortgage market. Furthermore, observations with missing or inconsistent information were dropped, resulting in 984 usable observations.

It must be noted that until the complete liberalization of interest rates in 1994, private mortgage interest rates were linked to the long-term prime rate which was controlled by the government, so that private mortgage interest rates were not necessarily in equilibrium. Therefore we may not obtain estimates of demand function by using these observations. However, we may still obtain estimates of the demand function because of either of the following two reasons; first, we used observations from 1988-1989 (summer) when there was excess supply in the market. In this case we can obtain estimates of the demand

function. Second, even if there was no excess supply in the market, after the complete liberalization of interest rates, more than 90% of private banks and other financial institutions determined fixed mortgage interest rates in the same way as before, namely by linking to the long-term prime rate. Therefore we can assume that these observations express equilibrium interest rates.

As for interest rates, they change with a household's contract date, varying month by month. We use the GHLC mortgage interest rate as the PC mortgage interest rate, and the city bank mortgage interest rate as the private mortgage interest rate. We also use the interest rate on postal savings (3 years or more) as the savings interest rate.

Unfortunately, current wealth data are not available but the data of accumulated wealth for downpayment are. Theoretically, we introduce precautionary saving which varies depending upon a household's life-cycle characteristics into our model. However, by limiting the sample to first-time buyers younger than 60, it is considered that the majority of current wealth is allocated to downpayment and other savings purposes are small. Therefore we estimate current wealth by using a household's downpayment.

Generally current wealth is not equal to a downpayment, because some households may allocate current wealth into savings or consumption, especially that related to house purchases. A household usually save for several purposes as well as for a downpayment. However, besides precautionary saving, saving for a downpayment is the main purpose of first-time buyers and accounted for the majority of a household's current wealth in Japan.

Japanese households have a greater incentive to own their own homes and accumulate wealth for a downpayment than in other developed countries because of higher housing prices.¹³ According to the GHLC report, first-time buyers put 72 ~ 75% of the whole accumulated wealth into downpayments and also allocate some for transaction costs which include tax, moving and agency costs and so on from the remainder. The GHLC also

¹³ Horioka (1985), Yoshikawa and Ohtake (1989), and Engelhardt (1994) indicate that high housing prices raise the level of saving in Japan.

reports that first-time buyers are thought to put most of their saving into their home purchases including transaction costs. From the ‘Survey on Life and Saving’ (Bank of Japan, 1989), the target saving for house purchase amounts to 17.21 million yen ¹⁴ against a 31.67 million yen purchase price (includes all types of houses and covers the all areas). According to the ‘Family Saving Survey’ (Statistics Bureau, Management and Coordination Agency, 1989), the actual accumulation of wealth for a renter who plans to purchase a house within the next three years amounts to 14.71 million yen on average. Although there is still a gap between target and actual wealth (2.5 million yen), the ‘Family Saving Survey’ (1989) reports that a renter saves 0.69 (gross) or 0.44 (net) million yen per year. Taking into consideration the fact that a renter who plans to purchase a house saves much more than a renter without such a plan, we can assume from these figures that a first-time owner allocates much of his/her accumulated wealth to a downpayment.

From these facts, a downpayment may not be equal to accumulated wealth. However, the small gap between them might be considered as precautionary saving or expense for transaction costs or consumption related to home purchase. Furthermore, a household whose head’s age is over 60 ¹⁵ may leave a larger part of current wealth for living expenses after retirement. So, given the above Japanese context, if we limit the data to first-time owners under 60, this kind of savings by first-time buyers can be considered to be small. We may, therefore, estimate the whole accumulated wealth variable using wealth allocated to downpayment and use the predicted value from this function as current wealth $\hat{w}$. The estimation of current wealth variable is described in the Appendix.

Labor earnings of households y_i is used for the proxy of future income as well as its own usage, which is estimated by the Goodman and Kawai (1982) method described in the Appendix. We use the predicted value from this function $\hat{y}_i$. The unit price of owner-occupied housing is used for the price of house P_H which is constructed from the unit cost

¹⁴ It is not clear that this figure includes transaction costs.

¹⁵ Most workers retire at 60 years of age in Japan.

function $\hat{P}_H$. Detailed descriptions are presented in the Appendix.

In addition to the HSC data, the consumer price index for the same two-year period was obtained from the Survey on the Consumer Price Index (Statistics Bureau, Management and Coordination Agency), which was used to deflate mortgage debt, the house value, current wealth, income, interest rate and housing price. Summary descriptive statistics for variables are reported in Table I.

4 Estimation Results

4.1 Estimated Coefficients

The estimates from the maximum likelihood estimation are given in Table II. Estimates of the coefficients of $\hat{w}$, $\hat{y}_t$, $RATE21$ and H in the m_2 function as well as $\hat{w}$, $\hat{y}_t$, $\hat{P}_H$ in the H equation are significant at the 5 % level and match expected signs.

The negative sign of the wealth coefficient in the private mortgage debt demand function (β) indicates that wealthier households have less need to borrow because Japanese households do not use mortgage borrowing for consumption or investment at the time of house purchase. An increase in the future income $\hat{y}_t$ induces a household to borrow more, suggesting a positive sign. The estimate of the coefficient of $\hat{y}_t$ is significant at a 5 % level and of anticipated sign. The coefficient of the interests gap, $RATE21$ is significantly negative, however this does not imply that PC and private mortgages are competing because there is still a large difference between these mortgage interest rates. Since private mortgage debt demand responds significantly to the gap of these two mortgage interest rates, a higher private mortgage rate or a lower PC loan rate would reduce private mortgage debt demand. The latter suggests a crowding-out effect by PCs in the mortgage market in Japan.

A young single household (*YNGSNGL*) who is under 35 years cannot borrow from a PC, so it borrows from the private sector, whereas a young married household under 30 years (*YNGMARR*) can borrow from a PC, so it does not borrow from the private sector.

However, estimates of the coefficients of these life cycle variables are not significant. The age of the household head (*AGE*) is also an important proxy for the life cycle of household. As the age of the household head increases, the household needs a larger house, thereby generating higher demand for mortgage debt. Since most households tend to finance within the PC loan limit, they will not borrow from the private sector as the household heads' age increases. Thus, the estimate of the *AGE* coefficient is significantly negative.

The private mortgage debt demand function includes variables related to PC loan constraints. A household which purchases a smaller house with floor space less than $50m^2$ or a larger house with floor space more than $240m^2$ can not borrow from the GHLC; such a household will borrow from the private sector. Other households which purchase medium size houses ($50 \sim 240m^2$) can borrow more from a PC loan, so they do not borrow from the private sector. Furthermore, the upper limit of borrowing varies according to the floor space, $50 \sim 125m^2$ (*SPACE1*), $125 \sim 165m^2$ (*SPACE2*) and $165 \sim 240m^2$; dummy variables are introduced for these effects. The estimated coefficient of *SPACE1* is not significant but of anticipated sign, while that of *SPACE2* is significant as well as displaying the expected negative sign. A household which resides in a higher housing price area (*AREA*) can borrow more, so a negative effect is expected. However, the estimated coefficient is neither the expected negative sign, nor is it significant. An individual proprietor and others engaged in professional services such as writers, painters, and so on (*PROPTRO*) are in a slightly worse position to borrow from PCs due to their job instability, so they borrow more from the private sector. The estimated coefficient is of expected sign. The P-value which is the observed significance level is 6%. An office worker (*OFFICE*) is slightly better positioned to borrow from PCs due to job stability, so he/she does not borrow from the private sector.

Furthermore, some households can borrow from their employers (*FIRM*) and do not need to borrow from the private sector. The coefficient of this dummy variable is significant and negative as expected. The significance at a 5% level and positive sign of the

parameter of H suggests a strong linkage between their housing consumption and private mortgage debt demand.

As for house value function, this includes current wealth as well the estimated labour earnings y_t . As mentioned before, in this context y_t is not a proxy for future income, but an element of life cycle income. Introducing both current wealth and labour income into housing consumption equation, Jones (1990) tests the importance of the current wealth effect on housing consumption. Maki (1993) estimates the current wealth (net financial wealth) as well as permanent income effects on the probability of housing purchase and finds that both effects are significant. An increase in y_t raises housing consumption (house value), which is consistent with the significantly positive signs of the parameters. A higher house price requires more funding for a household to purchase. The coefficient of $\hat{P}_H$ is significant and positive. A household which has children (*CHILD*) or lives with their parents (*PARENT*) needs more space, which increases housing consumption (house value). Although both coefficients are not significant at 5 %, they have the expected signs. A young single household (*YNGSNGL*) demands a lower amount of housing consumption, thus suggesting a negative sign, which is compatible to our estimates but are not significant.

When estimating housing loan demand, the tax treatment of housing purchases should be considered. A tax deduction for outstanding housing loans is available for recent home buyers and money gifts are tax-exempt up to a certain limit for the first-time buyer. However, these variables were omitted due to a lack of robust results.¹⁶

Finally, we test the hypothesis of (weak) exogeneity of housing consumption (house value, H). The exogeneity of the house value can be tested by the t-test of the hypothesis that $\frac{\sigma_{12}}{\sigma_{22}} = 0$, which can be tested by using $\widehat{\frac{\sigma_{12}}{\sigma_{22}}}$ in Table II. Since the t-value of $\widehat{\frac{\sigma_{12}}{\sigma_{22}}}$

¹⁶ The main reason for this might be that the tax credit imposes several eligibility requirements. For instance, floor space must be between 50 and 240 m^2 . A household which borrows from the private sector tends to be rationed in PCs because of its small (under 50 m^2) or large (over 240 m^2) floorspace. In this case, there are no eligible borrowers from the private sector.

equals 2.34, the hypothesis of ‘no simultaneity’ is rejected at the 5 % significance level. This result means that we must take into consideration the simultaneity of mortgage debt demand and housing consumption; thus conditional distribution to infer the wealth effects must be used.

4.2 Elasticity Comparison

Results of wealth elasticity of the probability of borrowing from the private sector as well as other elasticities are reported in the second column in Table III.

The conditional wealth elasticity of the probability of borrowing from the private sector is not elastic and is negative. Given the house value, a household does not borrow from the private sector when its wealth increases which means $\eta_w^\Phi < 0$. In other words, conditional upon the house value, when household wealth increases by 1 %, the number of borrowers decreases by 0.446 %. Some households stop (start) borrowing when their wealth increase (decrease). The future income elasticity $\eta_{y_i}^\Phi$ is almost unity. Remembering that we use y_i for a proxy for future income, a household borrows rather elastically when it expects future income to increase because it expects to be able to repay more. The conditional mortgage interest elasticity of the likelihood $\eta_{r_{21}}^\Phi$ is very inelastic, which implies that a decrease in the relative magnitudes of PC and private mortgage interest rates increases the numbers of borrowers slightly, because there is still a large absolute gap between these interest levels. On the other hand, η_H^Φ is more than unity, suggesting that the number of borrowers will increase rapidly when the house value increases. The increase in H levers up the private mortgage market strongly.

Similarly, the conditional wealth elasticity of private mortgage debt demand, $\eta_x^{E(m_2|H, m_2>0)}$, $\eta_x^{E(m_2|H)}$ where x expresses exogenous variables, are exhibited in the third and fourth columns in Table III. The former is the elasticity for borrowers (using non zero observations), while the latter is for all households (using all observations, overall elasticity). The former elasticity represents the conditional elasticity holding the probability of bor-

rowing from the private sector constant, while the latter exhibits the elasticity including the impact of changing the probability of borrowing. The latter (overall) elasticity for a household is composed of two elasticities which can be written as

$$\eta_x^{E(m_2|H)} = \eta_x^{E(m_2|H, m_2 > 0)} + \eta_x^\Phi. \quad (14)$$

The first term of the elasticity of RHS in equation (14) represents the conditional elasticity, holding the probability of borrowing from the private sector constant. The second component represents the elasticity of the probability of borrowing from the private sector.

As for the wealth elasticity, that for borrowers is much more inelastic than that for all households, which means that once a household has decided to borrow from the private sector, it changes the debt amount slightly but the number of borrowers shifts when wealth changes. Some households switch not to borrow from the private sector when wealth increases, so that the elasticity with all observations is greater. The conditional wealth elasticity for all households is -0.446. Given a house value, most borrowers reduce the amount of private mortgage debt by allocating additional wealth into the downpayment when wealth increases. Some wealthier households can quit borrowing by allocating the entire additional wealth to the downpayment, thus resulting in a reduction in the number of borrowers. On the other hand, when wealth decreases most borrowers increase the amount of debt, while some households start borrowing.

The number of borrowers changes rapidly if future income is expected to change. The income elasticity for borrowers is not elastic, while that for all households is elastic. This estimation result indicates that once a household decides to borrow, an average borrower changes the amount of debt slightly if it expects future income to change. However many non-borrowers start and many borrowers quit borrowing when they expect future income to change.

The conditional interest elasticity is very inelastic, and for borrowers, it is much more inelastic than for all households. It is also worth noting that the interest elasticity of not

borrowing $\eta_{RATE21}^{(1-\Phi)}$ is very inelastic ($\eta_{RATE21}^{(1-\Phi)} = 0.052$). An increase in $RATE21$ consists of an increase in the private mortgage interest rate r_2 , a decrease in the interest rate on savings r_s , a decrease in the PC mortgage rate r_1 keeping other two rates constant. Conditional upon house value, an increase in the private mortgage rate r_2 while keeping r_1 and r_s constant have a minimal impact on reducing the private mortgage debt amount of borrowers, and only a very few households switch not to borrow from the private sector by allocating more wealth into the downpayment by reducing consumption. Given H , a decrease in the PC mortgage rate r_1 while keeping r_2 and r_s constant would induce borrowers to borrow more from PCs because of their increased ability to make payments, thus reducing the amount of private mortgage debt slightly. On the other hand a decrease in $RATE21$ means a decrease in r_2 or increases in r_s or r_1 keeping other rates constant. A decrease in r_2 keeping the other two rates constant, have virtually no impact on increasing the borrower's private mortgage debt demand, and only a few households begin to borrow from the private sector. An increase in r_1 , keeping the other two rates constant, will reduce the upper limit of the PC loan, but only a very few borrowers change the private mortgage debt amount.

Generally a change of saving interest rate has an ambiguous impact on consumption or saving due to both substitution and income effects. In the present context, when r_s decreases keeping both r_1 and r_2 constant, a household could start to save and stop borrowing from the private sector at the same time by reducing consumption. On the other hand, a household could stop saving and start borrowing from the private sector at the same time by increasing consumption when r_s increases. However, estimation result exhibits that these situations were rare.

The overall elasticity of private mortgage debt amount with respect to the house value $\eta_H^{E(m_2|H)}$ is elastic while that of borrowers is not elastic. Recalling that η_H^Φ is more than unity, a change in the house value strongly induces a change in the private mortgage debt amount mainly due to a rapid increase in the number of borrowers. From this result, it

is useful to know how many households borrow rather than to what extent a household borrows to understand variation in the private mortgage market. Therefore, the private mortgage and housing markets are strongly linked to each other, especially through the number of borrowers, suggesting that the number of housing starts is a good indicator of boosting private mortgage market.

Finally, we can calculate wealth, income and price elasticities of housing consumption for all households.¹⁷ The wealth elasticity of housing consumption η_w^h evaluated at means equals 0.195. The income elasticity $\eta_{y_i}^h$ is 0.196, while price elasticity η_p^h is -0.660. Regarding the current wealth and income elasticities, Jones (1990) demonstrates using Canadian data that η_w^h and $\eta_{y_i}^h$ are significantly different because of capital market imperfections. Our results have very similar values. However, this result does not mean a perfect capital market because PCs provide a large amount of loans, which makes most households less rationed in the private mortgage market.

According to Rosenthal, Duca and Gabriel (1991), without controlling for credit rationing, the price elasticity is biased towards -1, while the income elasticity might not be biased by cancelling out biases due to different types of credit constraints. Horioka (1988) estimates both income and price elasticities of owner-occupied housing consumption by using data of recent and previous house purchasers in Japan. His estimates of η_y^h and η_p^h are 1.4 and -0.8, respectively. The price variable used in his model is the price of owner-occupied housing P_o , while ours is the unit price of housing P_H . However, according to his calculation $P_o = \vartheta P_H$ where $\vartheta = \text{constant}$, both price elasticities are equal in measure. Therefore, we can compare our estimate of price elasticity with his. His estimate is higher (in absolute value) than ours, which suggests that households in our data face less credit constraint than Horioka's, which is consistent with our assumption that most households are not credit constrained in the private mortgage market during our estimation period.

¹⁷ Since we assume that the quantity of housing services consumed is a constant flow from housing stock, we can calculate elasticities of housing consumption.

As for income elasticity, there is a substantial difference between his estimate and ours. He uses permanent income as an income variable which is calculated differently from ours. Accordingly, our respective estimates of income elasticities may be quite different.

5 Conclusion

Since mortgage debt demand in Japan is derived from a housing decision, simultaneity between housing consumption and mortgage debt demand is an important. This is why conditional inference for an estimation of the wealth effect is needed. We examine how many households borrow from the private mortgage sector and to what extent, as well as the determinants of private mortgage debt demand simultaneously with housing consumption. We exhibit that estimates would be biased without taking into consideration the simultaneity and wealth effect without using conditional distribution. The estimation results show that housing consumption and private mortgage debt demand are significantly correlated to each other; thus conditional inferences should be made to analyze the wealth effect by using the simultaneous Tobit equation system.

Results show that current wealth has a negative impact on private mortgage amounts as well as the likelihood of borrowing. This finding suggests that wealthier households have less need to borrow for housing purchases.

Conditional upon housing consumption (house value), current wealth impacts on the probability of private mortgage borrowing as well as debt demand. Both elasticities are low, so the number of borrowers and the amount of private mortgage debt change inelastically when wealth changes. The amount of private mortgage debt of borrowers changes less elastically than the number of borrowers as wealth increases. From this finding, we made the interesting observation that wealth has a more influential impact on the probability of borrowing than on the debt amount. Most borrowers slightly reduce their debt amount, but some borrowers cease borrowing when their wealth increases. Alternatively, most borrowers slightly increase their debt amount but some non-borrowers

begin to borrow when their wealth decreases. The private mortgage market is mainly adjusted not by the debt amount of borrowers but by the number of borrowers when wealth changes.

An increase in wealth decreases the private mortgage debt amount while boosting housing consumption at the same time, but the elasticity of the latter is not large. The private mortgage debt amount responds elastically to housing consumption, but housing consumption changes are rather inelastic with respect to wealth. A change in housing consumption leads to a change in the likelihood of borrowing from the private sector as well as the debt amount (high elasticity). However, borrowers' response is not as elastic, thus indicating that housing and private mortgage markets fluctuate very closely through the number of participants in the private mortgage market. The number of housing starts is strongly linked to the private mortgage market.

On the other hand, the private mortgage debt amount is very inelastic with respect to the mortgage interests gap between the public and private sectors. This fact suggests that since a mortgage interest rate in the Public Corporation is much lower than that in the private sector, a change in the private mortgage interest rate does not affect its mortgage debt amount strongly.

In our model, which accounts for features of the Japanese finance system as well as the simultaneity of mortgage demand and housing consumption, we do not apply a portfolio framework to estimate mortgage demand. Nevertheless, we find that separating the conditional wealth effect from the unconditional one using conditional distributions under a simultaneous Tobit estimation is also useful for the estimation of wealth effect using a portfolio framework.

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the author.

Appendix

House price, labor earning and current wealth estimations

It is necessary to impose a specification for the unit price of owner-occupied housing, $\hat{P}_H$. The following equation is used to create P_H . $\hat{P}_H = P_k^\theta P_l^{(1-\theta)}$, where P_k is a construction cost per square meter of floorspace, and P_l is the land price per square meter. For θ , the same value was used as that of Horioka (1988), namely $\theta = 0.3$. For P_k , data on the construction cost of a concrete block structure per square meter of floorspace from the Annual Survey of Statistics on Construction (Statistics Bureau, Management and Coordination Agency) was used. For P_l , data on the price per square meter of residential land from the Survey on Land Price (National Land Agency) was used. The P_k data are prefecture-specific whereas P_l data are ward-specific.

As described in Section 2, accumulated wealth for a first-time owner consists of a downpayment and precautionary expenses, the former being much larger than the latter. The current wealth variable consists of estimated life cycle wealth and transfer wealth (gift and bequests). Life cycle wealth, which consists of accumulation from past income, e.g., time deposits, securities, and retirement money, is estimated by regressing accumulated wealth for a downpayment on household income and a set of household characteristics. The estimation result for w is

$$\begin{aligned}
 w = & 239.44 + 0.022 \text{ INCAGE} + 9.62 \text{ AGE} - 0.20 \text{ AGE2} - 255.07 \text{ YNGSNGL} \\
 & \quad (0.31) \quad (7.6) \quad (0.3) \quad (-0.5) \quad (-0.6) \\
 & - 136.09 \text{ YNGMARR} - 128.01 \text{ PROPRTR} + 31.34 \text{ OFFICE} \\
 & \quad (-1.1) \quad (-0.6) \quad (0.5) \\
 & + 54.90 \text{ TECH} + 172.03 \text{ MANAGE} \\
 & \quad (0.7) \quad (1.5)
 \end{aligned}$$

where t-statistics are in parentheses, $R^2 = 0.13$. $\text{INCAGE} = \text{INCOME} * \text{AGE}$ where Income is a measurable income including those of all members in the family,¹⁸ AGE is the

¹⁸ Income is classified into 12 groups, the median value being used. Since after-tax income was not

age of household head, and AGE2 is the squared value of AGE. PROPRTR, OFFICE, MANAGE, TECH are occupation dummies for an individual proprietor, office worker, manager, and technician, respectively. Adding transfer wealth to the predicted value from the above equation, we obtain the current wealth variable $\hat{w}$.

In the calculation of labor earnings for households, the tax treatment of housing should be considered. The imputed rent on owner-occupied housing is not taxed. However, there is no information on imputed income in the data. Following Goodman *et al.* (1982), pre-tax labor income, $\hat{y}_l$, is estimated from measured family income regressed upon a variety of household characteristics including life cycle and occupation. The estimation result for $\hat{y}_l$ is

$$\begin{aligned} \hat{y}_l = & 532.02 + 0.62 \text{ AGE} + 0.13 \text{ AGE2} + 26.28 \text{ YNGSNGL} - 56.98 \text{ YNGMARR} \\ & \quad (2.7) \quad (0.6) \quad (0.98) \quad (0.2) \quad (-1.5) \\ & + 193.70 \text{ GCHILD} + 73.97 \text{ PROPRTR} + 42.85 \text{ OFFICE} \\ & \quad (4.1) \quad (1.6) \quad (2.1) \\ & + 254.83 \text{ MANEGE} + 18.83 \text{ SUBSIDY} \\ & \quad (8.7) \quad (1.0) \end{aligned}$$

where SUBSIDY is a dummy variable which equals 1 if a household previously lived in a subsidized rental house and GCHILD is a dummy variable for a married household with grown-up children, respectively. T-statistics are in parentheses and $R^2 = 0.29$.

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Table I: Variable Descriptive Statistics

<i>Variables</i>	<i>H</i>	<i>m</i>	<i>m₁</i>	<i>m₂</i>	<i>Downpayment</i>	<i>Income</i>	<i>Age</i>	<i>Sample Size</i>
<i>all households</i>	3927.6	2551.4	1754.4	264.0	1376.2	804.9	36.6	984
<i>borrowers*</i>	4018.8	2985.8	1767.6	1060.2	1033.0	793.4	35.8	245
<i>non borrowers*</i>	3897.3	2407.4	1750.0	0	1489.9	808.8	36.9	739

(Unit: ten thousand yen except Age and Sample Size.)

(* : Borrowers (non borrowers) from the private sector.)

Table II: Estimated Parameters of the Simultaneous Tobit Model

Variables	Estimates
constant	-241.81 (-0.40)
$\hat{w}$	-0.376* (-2.26)
$\hat{y}_i$	1.333* (2.16)
RATE21	-138.17* (-2.12)
FIRM	-1094.4** (-6.47)
PROPRTRO	412.78 (1.86)
SPACE1	-176.55 (-0.64)
SPACE2	-613.40* (-2.00)
AREA	90.65 (0.425)
YNGSNGL	116.53 (0.12)
YNGMARR	-97.35 (-0.34)
AGE	-44.16** (-3.30)
OFFICE	-502.0** (-3.30)
H	0.309* (2.01)
Constant	963.04 (5.06)
$\hat{w}$	0.568** (18.90)
$\hat{y}_i$	0.964** (5.54)
$\widehat{P_H}$	39.30** (13.06)
CHILD	101.98 (1.10)
PARENT	62.70 (0.30)
YNGSNGL	-642.5 (-0.98)
$\frac{\widehat{\sigma_{12}}}{\sigma_{22}}$	0.410* (2.34)
$STD(\varepsilon)$	1450.8** (27.10)
likelihood	-9069.72
sample size	984

(Numbers in parentheses are t-statistics.)

(First 13 slopes are for m_2 .) $(\sqrt{\sigma_{11}} = 1515.8, \sqrt{\sigma_{22}} = 1071.0, \rho = 0.290.)$

(* : significant at the 5% level.)

(** : significant at the 1% level.)

Table III: Estimated Conditional Elasticities of Private Mortgage Debt Demand

Variables	η_x^Φ	Cond. Elasticity $\eta_x^{E(m_2 H)}$	
		non zero obs.	all obs.
$\hat{w}$	-0.446	-0.124	-0.583
r_{21}	-0.155	-0.049	-0.204
$\hat{y}_l$	0.940	0.291	1.249
H	1.064	0.342	1.404
sample size		245	984

(* Elasticities are estimated at each mean.)

Fig. 1 Change in Interest rates 1977-1994

