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HOUSING FINANCE IMPERFECTIONS AND PRIVATE SAVING: A COMPARATIVE SIMULATION ANALYSIS OF THE U.S. AND JAPAN

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ABSTRACT

This paper presents a life-cycle simulation analysis of the interaction among savings decisions, housing purchase decisions, and the tax system in the United States and Japan. To investigate this issue, we first document the stylized fact that the typical Japanese household purchases a house later in the life-cycle with a higher downpayment ratio than its U.S. counterpart. Second, a life-cycle simulation model that includes the housing purchase decision is constructed and used to compare the behavior of typical U.S. and Japanese households. The Japanese household is induced to save more early in the life cycle in order to meet the higher downpayment requirement. The saving-consumption pattern resulting from a higher growth rate is shown to contribute to a higher aggregate saving rate in Japan compared to the U.S. However, the contribution of the induced early saving due to the downpayment requirement seems to be too small to explain a large differential in the saving rates of the two countries. Only if we introduce a bequest motive can the model generate the observed saving rate in Japan. Finally, tax reform concerning the tax deductibility of mortgage interest payments or the tax exempt status of interest income is shown to have a small impact on the aggregate saving rate in either country. For example, the introduction of tax-exempt saving in the U.S. would increase the saving rate by only 1.5%.

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1. INTRODUCTION

It is widely noted that one of the major differences between the U.S. and Japanese economies is found in the institutions and regulations of financial markets. In addition, the tax incentives for saving and borrowing in the two countries are quite different. Most of the interest income from consumer savings is tax-exempt and interest payments of consumer mortgages and debts are not tax deductible in Japan, while the opposite is true in the United States.* Institutional arrangements concerning housing, one of the major expenditure items in a lifetime for most consumers, are also quite different in the two countries. Many economists have suggested that differences in housing financing between the two countries may be partially responsible for the large gap in the personal saving rate between the two countries. (See Hayashi (1986) for a survey of the literature.) In a world with perfect capital markets where a consumer can borrow and lend over his lifecycle, whether a consumer decides to rent housing or purchase a house would not have any effect on the lifetime consumption-saving pattern. However, in the presence

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* In Japan, interest income from the following savings (with a ceiling on principal amounts) are tax-exempt: (i) regular postal saving up to 3 million yen; (ii) postal saving earmarked for housing purchase up to 0.5 million yen; (iii) "Maru-yu", that is, any deposits in banks securities and mutual funds, up to 3 million yen; (iv) "special maru-yu", that is, government and municipal bonds, new issues and secondary, up to 5 years after issue, up to 3 million yen; and (v) only for employees of age 54 or younger, for the purpose of accumulating assets for housing and retirement funds up to 5 million yen. Thus a young employee who wants to save for housing purchase can receive tax-free interest up to 14.5 million yen (= $90,625, if $1=160 yen). Even beyond the tax-exempt ceiling, there are financial instruments (discount bonds issued by investment banks and governments) which are subject to a low tax rate (16%) regardless of the income tax bracket of the bond holder. About 58 % of personal savings are in one of the above forms of tax exempt savings (Bank of Japan (1986; p.158)).

of a liquidity constraint (i.e., a downpayment requirement) purchasing a house many create a distortion in the lifetime consumption-saving decision. A higher downpayment requirement may induce households to postpone consumption early in the lifecycle in order to build up enough assets to qualify for buying a house.

The goal of this paper is to investigate the effect of tax incentives and downpayment requirements on households' tenure choice (own or rent) concerning housing and on consumption-saving patterns, with a comparison of the United States and Japan in mind. In particular, a life-cycle simulation model will be constructed to quantify the effect of these policies on the personal saving rate. The methodology is based on Slemrod (1982), which constructed a lifecycle model with endogenous home ownership decisions.* He showed that although the favorable tax treatment of owner-occupied housing in the United States favors an early purchase of housing, the downpayment constraint induces the consumer to delay the purchase to avoid distortion in the consumption- saving pattern. Thus, an optimal lifetime pattern of tenure choice of housing is determined as a tradeoff between the tax incentives and the required distortions in the lifetime consumption stream.

In this paper, we apply an expanded version of the Slemrod model to a comparative study of the U.S. and Japanese housing markets. The model predicts that due to the imperfect capital market, transaction costs and the relatively higher housing price, the Japanese are

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* As in Slemrod's model, land, a non-reproducible asset, is not explicitly introduced in our model. The value of land relative to total household wealth is much higher in Japan than in the U.S. Moreover, land has presumably appreciated more than financial wealth. The potentially important role of land in the saving process and its implications for the differential performance of the U.S. and Japan are not explored in this paper.

induced to save more toward the down payment and to acquire a home later in their lifecycle.

One simplification adopted in the paper is that the model considers only the demand side of the asset. The supply of housing is not modelled and the general equilibrium response of prices to changes in policies is not included in the analysis.

Reasonable values are substituted from the stylized facts of the two countries. Most parameter values in the simulation model are based on observed data of the U.S. and Japanese economies. Some parameter values are chosen so that the tenure pattern and saving rates that our model predicts are matched with the observed tenure pattern in each country.

Exercises with the simulation model are developed to show how much the difference in tax incentives contributes to the savings rate gap between the two countries. It is particularly interesting to investigate how tax reform would affect the aggregate saving rate and housing tenure choice. In Japan, a proposal to abolish the tax exemption for saving and replace it with a uniform low tax rate has been gaining momentum recently. Furthermore, a tax break for the purchase of owner-occupied housing, in one form or another, has been proposed. In the United States, incentives for saving have been introduced in the form of the all-savers' certificate and individual retirement accounts, although these programs have been cut back recently. In addition, some recent tax reform proposals, in particular flat tax proposals, feature the elimination of the tax deductibility of home mortgage interest payments.

In the discussion of tax reform in either country, no one has presented quantitative estimates showing how much the house tenure

pattern and the saving rate would change due to the proposed reform. This paper will take up this task using a simulation model.

In Section 2, we describe a life-cycle model with housing tenure choice, which is a special case of Slemrod's (1982) model. Sections 3 and 4, respectively, summarize the stylized facts of the U.S. and Japanese housing markets. Section 5 presents the results of various exercises using the simulation model to investigate the effect of changes in the economic environment in both countries. Section 6 offers some concluding remarks.

2. A Lifecycle Model with Housing Tenure Choice

In this section, we describe a six-period life-cycle model which will be used for the simulation analyses to be discussed later. Each period is meant to represent ten years of a person's adult lifetime. The household, which lives six periods, chooses the consumption of a composite commodity and housing services for each period over the lifetime. Housing services may be obtained either by purchasing a house or renting housing. Imperfect capital markets are assumed in that the household cannot borrow to finance nonhousing consumption. The household can, however, obtain a mortgage toward purchase of a house, provided it can come up with a downpayment which is some fraction of the house value. The liquidity constraint may be binding for two reasons. First, when income early in the life cycle is less than income later, as will be assumed, consumption smoothing may become impossible. Second, if owner-occupying as opposed to renting is preferred, the household has to save in order to accumulate enough wealth for the downpayment. Even if the liquidity constraint for consumption smoothing is binding, there may be positive saving in order to build up the downpayment.

The desirability of owning a house comes from two sources. First, it is assumed that a house owned would yield services with higher utility than the identical house if rented, even if the cost is identical. This assumption is meant to represent some advantages of eliminating the principal-agent relationship if one rents from himself, i.e., a renter cannot alter, paint and improve a house as desired, and a renter is subject to a risk of termination of lease or rent increase in the future. Second, in the United States, the imputed income from owner-occupied housing is untaxed, while interest payments are tax deductible and interest income from saving is taxable. This feature makes owning a house more attractive than renting one, unless there are offsetting tax advantages offered to landlords. This argument does not apply identically to Japan, where interest payments are not tax-deductible and most of personal interest income is practically tax-exempt. To the extent that rental income is taxed, however, there is a tax-related advantage to owning housing as opposed to renting in Japan as well as in the U.S.

It is assumed that in the first period the household cannot purchase a house because of the liquidity and downpayment constraints. Likewise, by the beginning of the last period, the household must sell any owned housing and move into a rental unit, consuming all the proceeds of the house sale in the last period. (We abstract from the bequest motive until later.) Thus the household has a choice of owning a house during any of the second, third, fourth and fifth periods, but can only buy once. For each own/rent lifetime pattern, the household can calculate the optimal consumption/saving pattern by maximizing the discounted sum of lifetime utility subject to the lifetime budget constraint, the liquidity and

downpayment constraints. By comparing the maximized levels of life-time utility for different patterns of tenure choice, the household picks the own/rent pattern that yields the highest utility. (For simplicity, depreciation on a house is ignored.)

We assume housing purchases and sales take place at the end of a period. When a house is purchased with a downpayment d of the house value, the downpayment expenditure is deducted from income of the period of house purchase. The mortgage debt (1-d) becomes (1+R)(1-d) at the beginning of the next period. An equal payment of V for m periods amortizes the mortgage debt. (Later, m=2 for Japan and m=3 for the United States will be chosen). The interest portion of the mortgage repayment is tax deductible in the United States. Thus the "net" mortgage repayment V(m) in the United States is the mortgage payment less the (deductible) interest portion of the repayment for the m-th installment. When a house is sold, after the mortgage is paid up, the value of the house is used for consumption after the period of the sale.

The instantaneous utility function is assumed to be log-linear in consumption and housing services and lifetime utility is assumed to be additively separable over time. For example, suppose that a household purchases a house at period t(b) and sells at period t(s). The household has to solve the following problem: Maximize with respect to t(b), t(s), {c(t), t = 1, ..., 6}, {h(t), t=1,..t(b), t(s)+1,.., 6}, H,

$$\sum_{t=1}^{t(b)} \beta^{t-1}\{\log c(t) + \alpha \log h(t)\}$$

$$+ \sum_{t=t(b)+1}^{t(s)} \beta^{t-1}\{\log c(t) + \alpha \log \gamma H)\}$$

$$+ \sum_{t=t(s)+1}^{6} \beta^{t-1} \{\log c(t) + \alpha \log h(t)\}$$

subject to, $A(0) = 0$,

$A(t) = (1+R(1-\tau))A(t-1)+y(t)-c(t)-P_r P_h h(t), \quad t = 1,\ldots,t(b)-1$

$A(t) = (1+R(1-\tau))A(t-1)+y(t)-c(t)-P_r P_h h(t)-dP_h H, \quad t = t(b)$

$A(t) = (1+R(1-\tau))A(t-1)+y(t)-c(t)-V(m)(1-d)P_h H, \quad t=t(b),\ldots,t(s)-1$

$A(t) = (1+R(1-\tau))A(t-1)+y(t)-c(t)-V(m)(1-d)P_h H + P_h H, \quad t = t(s)$

$A(t) = (1+R(1-\tau))A(t-1)+y(t)-c(t)-P_r P_h h(t), \quad t = t(s)+1,\ldots,6$

$$A(t) \geq \max[0,\ dP_h H + \sum_{m-1}^{t-t(b)} \{V - (V-V(m))/\tau\}$$

[liquidity constraint] $\quad t = 1,\ldots,5$

$A(6) = 0$, [no bequest condition]

where $y(t)$ and $c(t)$, respectively, are labor income and consumption in period t; $A(t)$ is the end-of-the-period financial asset value; h is the size of a rental unit (which could vary every period); H is the size of an owner-occupied unit (which remains constant once purchased); R is the interest rate on financial assets and liabilities; P_r is the price per period of a rental unit; P_h is the price of the owner-occupied house; γ, τ, d, are parameters, respectively, representing the pride of ownership coefficient, the tax rate on income from saving and the required downpayment ratio. There is an implicit arbitrage condition assumed between rental property investment and financial asset investment. P_r equals R due to arbitrage between the financial asset and real asset if both incomes are taxable as in the United States. P_r equals $R/(1-\tau^r)$ if interest income on financial assets is not taxed but rental income is taxed, as in Japan, where τ^r is the tax rate on rental income.

The liquidity constraint implies that total borrowing must be less than or equal to the value of owned housing. The calculation of V(m) needs some explanation. For Japan, where there is no tax deductibility for interest payments, $V(m) = V$, and the equal installment is calculated from a condition that the mortgage is just paid up after the maturity of mortgage. For the United States, V(m) represents the equal payments of mortgage less the tax rebate resulting from tax-deductibility of the mortgage interest payment.*

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* For Japan, suppose that the mortgage matures in 2 periods (twenty years). The condition of equal payments is

$$(1+R)\{(1-d)(1+R)-V\}-V = 0.$$

Solving this, we have

$$V(m) = V = (1-d)(1+R)^2/(2+R), \qquad m = 1, 2.$$

$$V(0) = 0, \qquad m = 3,\ldots$$

In addition, interest income from saving is tax-exempt, i.e., $\tau = 0$.

For the United States, suppose that the mortgage matures in 3 periods (thirty years). The condition of equal payments is

$$(1+R)[(1+R)\{(1-d)(1+R)-V\}-V]-V = 0$$

Solving this, we have

$$V = (1-d)(1+R)^3/\{1+(1+R)+(1+R)^2\}.$$

In the period of first installment, the interest portion of mortgage payment is $(1-d)R$. Therefore multiplying the tax rate τ, we obtain the amount of tax saving, $\tau(1-d)R$. The "net" mortgage payment is defined as, $V(1) = V - (1-d)R\tau$.

Since the principal balance is shrinking as the installment continues, the interest portion of installment changes. Accordingly the net mortgage payment in the m-th installment is calculated as:

$$V(2) = V - \{(1-d)(1+R)-V\}R\tau$$

$$V(3) = V - [(1+R)\{(1-d)(1+R)-V\}-V]R\tau.$$

Due to time separability and log linearity of the utility function, backward induction yields an explicit solution for optimal consumption, (rent/own) housing service for all periods.

One extension of the model that we consider is to include a bequest motive. In particular, we specify that a fraction q of benefactor's first-period income is left at the point of death. Assuming that heirs are thirty years younger than parents, bequests are equally divided by the heirs who are at the end of their third period of life. The population is larger and the lifetime income is higher for later generations. Thus, the size of the bequest on the receiving end has to be adjusted accordingly. The budget set must be modified as follows:

$$y(3,q) = y(3) + qy(1)/\{((1+n)(1+g))^{3}\}; \qquad A(6,q) = qy(1),$$

where n is the population growth rate, and g is the (generational) income growth rate.

3. Characteristics of the U.S. Housing Market

Data for mortgage financing with a government guarantee are available from the U.S. Department of Housing and Urban Development (HUD). In 1979, the average ratio of mortgage value to the value of a new one-family house whose finance was government guaranteed was 0.921. This ratio seems very high, partly due to a sample bias of government guarantees. The average loan-to-value ratio, 1-d, of conventional mortgage financing, according to the Federal Home Loan Bank Board (1982), for a new home was .731 in 1980 and .748 in 1981. Based on these data, our first stylized fact is that the downpayment ratio is about 25 to 30 percent for conventional mortgages and only about 10 percent for housing with government loan guarantees. We select 25% as a benchmark of the U.S. downpayment ratio.

Second, the average age of mortgator was about 30 years old for an owner occupant transaction in 1980, according to the FHA Trends of Home Mortgage Characteristics. Another source, Annual Housing Survey, confirms that among the cohort of 25-30 year-old household heads, more than 50 percent own a house rather than a rent.

Third, the average maturity of a mortgage is about 30 years, according to HUD (1979, p.295). Fourth, the house-value/annual-income ratio is 1.97 for a typical transaction of one-family housing, according to HUD (1979, p. 134).)

Lastly, the lifecycle income pattern of the U.S. household is calculated by multiplying the average income for an age bracket by the labor participation rate in 1980. (Source: U.S. Department of Commerce (1981), Department of Labor (1985).) As a proportion to the 20-30 year old average income, the income of the 6 age brackets we are interested in are calculated as follows, after normalizing so that $y(1)+y(2)+...+y(6) = 1$:

$$y_t(1) = 0.169; \quad y_t(2) = 0.248; \quad y_t(3) = 0.257;$$

$$y_t(4) = 0.218; \quad y_t(5) = 0.108; \quad y_t(6) = 0.000.$$

Since this income pattern with respect to age bracket is an observation at a point of time t, the lifetime pattern of a generation must be estimated in order to be used in the lifecycle maximization problem of one particular generation. In the steady state, this can be done by multiplying the growth rate of (real) lifetime income over a generation. We assume that a lifetime income of a generation later receives income in every age bracket g higher income than a generation before: $y_{t+s}(k) = (1+g)^s y(k), \qquad k = 1, 2, \ldots, 6.$ Therefore, from the cross-section observation, we simulate the lifetime income pattern as follows:

$$y_{t-k-1}(k) = (1+g)^{k-1} y_t(k), \qquad k = 1, 2, \ldots, 6.$$

The decade population (of those 15 years old and over) growth rate, n, is calculated as 20.04%, the rate observed from 1970 to 1980. The decade income growth rate over one generation (10 years apart), g, is fixed at 10%.*

4. Stylized Facts in the Housing Markets in Japan

4.1 Loans vs. Self-financing**

The ratio of downpayment (literally translated as a ratio of self-financing) is defined by the ratio of the average amount the owner of new home raised to the average cost of construction or purchase of the home. In the 1980s, the ratio of downpayment has been about 40 percent for both (custom-made) home builders and home purchased from developers. The rest, about 60 percent of purchase costs, comes from subsidized and privately financed loans. (See TABLE A4-1a for details.)

However, there are two problems with using these figures. First, "downpayment" in this table is literally defined as "the portion of self-financing", including the owner's savings, gifts to the owner, and sales of another real asset. "Loans" in this table refers to funds other than the owner's. If a new owner borrows without collateral some amount of money from his parents and applies it toward the "downpayment" to the developer, the amount of money

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* There are various ways to approximate the decade income growth, depending on which income measures and which deflator is used. For example, the per capita real GNP growth over the past ten years less the population growth rate is about 10%.

** The facts are summarized from the survey study by the Ministry of Construction in Japan, conducted annually since 1974. (See Ministry of Construction (1986).) The survey of 1985 was conducted to about ten thousand individuals who ordered custom-made homes or bought homes from developers.

would still be counted as "loans" instead of "downpayment". The ratio of "downpayment" in this table may therefore be biased downward. Although the exact division between "self-finance" and "loans" in this Japanese table may not be comparable to the division into "downpayment" and "mortgages" in the United States, this is the closest approximation possible and the direction of possible bias would not weaken our argument.

Second, the ratio of 40% is inclusive of second time buyers who have trade-ins. If we take the downpayment ratio of the first-time buyers only, the downpayment ratio is about 35%. (See Table A4-1b.) In light of these facts, a plausible average for the downpayment ratio for the first-time buyer is about 35%. This is our <u>first stylized fact</u> for the Japanese housing market.

4.2 Average Age of New Owners

The average age of the head of households who built custom-made house in 1985 is about 43.9 years old. However, if only first-time buyers are surveyed, the average age is about 40 years old. (See TABLE A4-2 for details.)

This evidence is not quite sufficient for the purpose of our study of an own/rent tenure choice in the life-cycle context. Although it shows a distribution of ages of purchasers, it does not show in the cross-section how many of the cohorts have previously owned houses. In order to overcome the difficulty, we consult a source of representative cross-sectional data in Japan, the Survey of Saving Movement, collected by the Statistics Bureau of the Prime Minister's Office. The survey shows that the house ownership ratio (among the cohort) increases monotonically up to the age of 65. At

the age of 65, 86.7 % of heads of households own housing. It is between the ages of 35 to 39 when the majority of the cohort becomes a home owner. The ownership rate increases rapidly between age of 30 and 40. (See Table A4-3 for details.)

We present the second stylized fact: In Japan, the average age of initial home purchase is about 40 years old.

However, looking at the percentage of households holding liabilities for purchase of houses and/or land, we note that less than 40% of households hold such liabilities. Investigating other statistics, we can conclude that more than one third of house owners have no liabilities connected to housing. This is supporting evidence that liabilities due to home/land purchases are rather quickly paid up.

4.3 Japanese Idiosyncrasies: Extended Families

Care must be taken in comparing the Japanese housing market with its U.S. counterpart, in light of the prevalence of extended families. It is still common in Japan for young adults between the age of 18 and the time of marriage to live with their parents, if they live in the same town. The prevalence of this arrangement is partly due to the high relative cost of housing, both rental and owner-occupied, and partly due to social customs.

Even after their marriage, it is not uncommon that children continue to live with their parents. This phenomenon appears in the above-mentioned survey concerning the question of what kind of housing the new owner had before. About 13% of owner-construction and 6% of buyers used to "live together (with family)." This is a significant proportion, because as mentioned before the survey includes replacement and improvement demand for homes. (See TABLE A4-4.)

It is common in Japan that when parents become very old, or especially when one of them dies, they are "looked after" by one of the children. A parent (or parents) might move into a house of one of the children, usually the eldest son; or the family of a child might move into the parents' house. In the former case, they lose the "head of household" status and become a dependent in the household survey, thus dropping out of statistics using a classification by the age of head of households. In the latter case, in "return" for being taken care of, it is usual that the child who looks after the parents inherits the parent's home. (This is an extreme form of "strategic bequests", as advocated by Bernheim, Shleifer and Summers (1985).) The parent(s) usually remains as the legal owner of the house. One reason for this arrangement is that for real estate, as opposed to financial securities, the inheritance tax is reduced since an assessed value for the inheritance tax is usually less than the market value. In either case, it is rare that the elderly sell the home in order to move into a rental unit. . These social and economic aspects in Japan partly explains why the ratio of homeowners among 65 years old and over, among "heads of households", does not (seem to) decline.

To repeat, the second case implies that a typical Japanese family keeps an owner-occupied house, or even buys a new larger home, after retirement. This is very much in contrast to the typical U.S. household that sells a big house after the children become adults. This aspect might not be adequately dealt with in a model based on the standard life-cycle theory, in particular Slemrod's life-cycle model of tenure choice.

Careful consideration of the bias caused by extended families in

our study must be given. As for the effect of the living-in arrangement after parents become old, we have two conflicting effects on the validity of our study. If the first case (parents moving in to their children's home) is dominant, we do not have to worry about the comparability of the two countries, since an apparently high ownership ratio among the retired household heads is caused by selection bias (upward). In other words, in reality as opposed to in the data, many sell their houses and live with a son's family or a daughter's family. Thus, the life-cycle framework of own/rent tenure choice still applies. However, if the second case (a son's or daughter's family moving in to parent's home) is dominant, then a bequest motive should be seriously modeled, and it may be the case that we have to argue that the difference in saving and house-ownership between the U.S. and Japan is due to the extended family practice and a peculiar bequest motive in Japan. (See Hayashi (1986) for the extended family explanation of why the Japanese saving rate is so high.) Since we will not analyze the bequest motive seriously, we are implicitly assuming the second aspect of extended family relationship to be relatively insignificant. Further theoretical and empirical analysis is required to investigate how much the Japanese extended family relationship would affect housing tenure choice and saving decisions.

4.4 Lifecycle Labor Income Pattern and Price of Housing

We need the lifecycle labor income pattern for the typical Japanese household for our simulation model. The method of calculation is the same as the United States. The result is given in Hayashi (1986: Table 3):

$y_1(t) = 0.09$; $y_2(t) = 0.22$; $y_3(t) = 0.28$;

$y_4(t) = 0.29$; $y_5(t) = 0.13$; $y_6(t) = 0.00$.

The above number is the cross-section observation at time t of the income pattern with respect to age brackets. As was discussed in the preceding section, the income pattern of a particular generation derived from this table depends on the growth rate of labor income over generations: $y(k) = (1+g)^{k-1} y_t(k)$, $k = 1,2,...6$, where g is the growth rate of lifetime (real) labor income over a generation. The decade income growth rate, g, is approximated at 40%.* The population (age 15 and over) growth rate, n, is approximated at 13.05%.

Lastly, some kind of an indicator of housing price is required. It is difficult to pin down the price of housing relative to consumption goods. In Japan, about a third of the price of housing services can be traced to land. The average housing-price/annual-income ratio for buyers of a house with a land (excluding those who rent land and who are given land by family and relatives), constructed from a survey by Ministry of Construction (1982, p.82), was 5.29.

5. Simulations

5.1 Benchmark

In this section, the model presented in section 2 is used as a simulation model with relevant parameter values set from observed facts summarized in sections 3 and 4. Those parameters for a typical resident in each country are summarized in Table 5-1.

Insert TABLE 5-1 about here

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* Again, the income growth rate can be approximated several ways. For example, the growth rate of household disposable income less the CPI growth rate less the population (age 15 and over) growth rate from 1970 to 1980 would yield about 41%, while the per capita real GNP growth rate is about 40%.

First, we calculate the optimum housing tenure choice predicted by our simulation model. Given a rent-own pattern of housing for six periods, maximum lifetime utility is calculated by solving a dynamic problem of consumption (size of housing and consumption goods) and saving. The model then compares the maximized values of lifetime utility to decide the optimal pattern of tenure choice.

The model, as summarized as the benchmark case in Table 5-2 predicts that the representative Japanese resident rents in periods 1, 2 and 6 of his life, and that the representative U.S. resident rents in periods 1 and 6 only. That is, the typical Japanese purchases a house when he is 40 years old with a 20-year mortgage and the typical American purchases a house when he is 30 years old with a 30-year mortgage. These predicted patterns match the stylized facts summarized in previous sections.

The saving rate predicted by the model is 8.81% for the U.S. and 11.16% for Japan. Hayashi (1986) calculates private saving rates for the two countries after correcting for the difference in statistical definitions. According to Hayashi's estimates, the average private saving rates for the U.S. and Japan during the 1970s were 8.0% and 18.3% for Japan, respectively. Thus the prediction for the U.S. is quite reflective of the stylized fact but the prediction for Japan falls short of the actual rate by 7 percentage points.

The model also shows that in Japan, the housing stock share in national wealth is much lower than in the United States despite the high saving rate. We will investigate contributing factors to the low housing stock in Japan by simulation experiments later.

We next check to see how robust the benchmark result is with respect to the pride of ownership parameter about which we do not

have strong confidence. The tenure choice pattern and the saving rate predicted by the model was found to be not sensitive with respect to this parameter for either country. (See Table A5-1)

In the rest of this section, simulations with respect to the bequest motive, downpayment ratio and the income growth rate will be conducted to evaluate the impact of changes in the financial institutions and economic environment on the housing market.

5.2 Bequest Motive in Japan

According to the above results, the saving rate predicted by the simulation model seems rather too low for Japan. One possible source for saving, which has not been incorporated so far, is the bequest motive.* If the the oldest generation does not consume all its wealth, especially the proceeds from the house sale which becomes available at the beginning of the last period of the lifecycle, then the aggregate saving rate would increase.**

Thus, we investigate how large a bequest motive is required to predict a saving rate comparable to the actual rate. Table 5-2 shows that if a bequest motive that directs the benefactor to leave three times his first-period income to his heir, then the predicted saving rate in the model to be 17.38%, which is quite comparable to the actual rate of 18.29%.

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* One of the reasons that the bequest motive is more important in Japan is the popularity of the extended family relationship. If parents expect to live with (and/or to be taken care of by) children, they might leave bequests in return.

** Without a bequest motive, an assumption that the individual sells the house at the beginning of the sixth period is not critical. With a bequest motive, the assumption becomes problematic, because in Japan houses are often used as a vehicle for making a bequest due to the tax advantage relative to bequeathing financial assets. A serious treatment of bequest strategy is an important topic for future research.

Insert TABLE 5-2 about here

5.3 Simulations with respect to downpayment ratios.

We next investigate how much difference the downpayment constraint makes in the housing tenure choice and the saving rate. Of course, the higher the downpayment ratio, the more distortion in the lifetime consumption pattern is required to finance the same amount of owned housing.

Table 5-3 shows how sensitive the housing tenure pattern is with respect to changes in the downpayment ratio. The U.S. housing tenure pattern would look like Japan's (housing purchase postponed until the third period) if the downpayment requirement was raised to 40%. In Japan, the tenure pattern currently observed in the U.S. would emerge only if the downpayment ratio was reduced to a mere 7.5%. Therefore, although a change in the downpayment ratio could alter the tenure choice pattern, the change would have to be very large. The observed tenure pattern in each country is predicted for a wide range of the downpayment ratios around the respective benchmark cases.

Table 5-3 also shows that the saving rate is positively related to the downpayment ratio. An increase of 10% in the downpayment ratio increases the saving rate by slightly less than one-half a percentage point in each country, given that the tenure choice pattern is not altered. The magnitude of the downpayment ratio effect is not as large as one might think, because there are two offsetting impacts from a higher downpayment ratio. First, higher saving is required for a given size of house. Second, a higher downpayment ratio causes a smaller house to be purchased given the tenure choice pattern. The simulation results show that the first

effect is only barely dominant.

Table 5-3 also shows how the relative share of housing in national wealth would be affected when the downpayment ratio is changed. When the downpayment ratio in Japan becomes as low as 7.5%, so that the tenure pattern becomes identical with that of the United States, the housing share in national wealth becomes comparable, too. However, the housing share would be way down if the bequest motive is strong.

In sum, this model suggests that the difference in the required downpayment ratios in the U.S. and Japan is not a major source of the difference in the saving rate. However, a large enough decline in the required downpayment ratio in Japan would induce a saving rate and lifecycle tenure pattern similar to that of the U.S.

Insert TABLE 5-3 about here

5.4 Simulations with respect to the Income Growth Rate

First, note that the model is constructed in such a way that the slope of the earning profile for one generation is positively related to the expected income growth over generations. This feature comes from the fact that the observed cross-section data has to be converted into a steady state lifetime earning profile. Thus, in the following experiments, faster growth implies a steeper earnings profile.

Results of the sensitivity analysis with respect to the income growth rate are summarized as follows. It is well-known that the aggregate saving rate increases if the steady state growth rate of labor income over generations increases as long as the younger generations are the savers. This is confirmed in our simulation

model. In fact, if the Japanese growth rate is only 10%, the growth rate of the United States, then the predicted Japanese saving rate (without a bequest motive) would be 7.18%, which is even below the current U.S. saving rate simulated in the model. The tenure choice of the Japanese case is not affected by the change in the income growth rate.

However, in the U.S. the renting period is extended by ten more years if income grows at the Japanese rate, i.e. the age earning profile becomes steeper. The steeper earning profile implies that the utility penalty imposed by the distortion caused by saving toward downpayments becomes more burdensome. The saving rate is increased to 9.58%, which is far short of the actual and less even than the simulated Japanese saving rate.

5.5 Simulations of tax reforms

Our final simulation experiments concern changes in the tax laws which determine incentives for saving and borrowing. As was discussed in the introduction, the tax incentives affecting saving and borrowing in the two countries are quite different.

The United States and Japan differ in two aspects: tax-exemption of an interest income from saving and tax deductibility of mortgage interest payment. For each aspect, the simulation will be conducted for hypothetical situations given all other parameters.

Our model gives simulation results shown in Table 5-4 for a full range of interesting policy questions both in the United States and in Japan: How much would the U.S. low saving rate be stimulated if interest income becomes tax exempt? How would tenure choice and average housing size be affected if mortgage payments become non-deductible? What are the combined effects of tax-exempt saving and

the interest payment non-deductibility? The last question can be also paraphrased as follows. If the United States switched to the Japanese tax system, what would happen to the saving rate and housing tenure pattern?

Insert TABLE 5-4 about here

Some economists think that the United States saves too little and propose ways to increase the saving rate, including adopting a more favorable tax treatment of interest income. The experiment of issuing all savers' certificates was one such attempt, though temporary. The results of allowing tax-exempt saving is shown in the (YES-YES) column in TABLE 5-4. The simulated aggregate saving rate increases by 1.5%, without changing the tenure choice pattern, if interest income from savings becomes tax-exempt, as in "maru-yu" accounts in Japan. The increase is not insignificant, if one is interested in raising the saving rate. However, even with an increase of 1.5%, the gap in the savings rates of the two countries would remain large.*

Suppose next that mortgage interest payments become not tax deductible in the United States. This is the case indicated by (NO-NO) in TABLE 5-4. The model predicts that the saving rate would be reduced by a small amount, less than 50 basis points. This result contrasts to the usual presumption that the tax deductibility of interest payments reduces the saving rate because it makes the cost of borrowing less. However, since buying a house does not represent

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* Note that the model is not general equilibrium in nature, so that the interest rate is held constant when tax policy and the capital stock are changed. Introducing general equilibrium considerations would presumably dampen the predicted changes in the saving rate.

dissaving (rather a change in portfolio) the aggregate saving rate in fact increases when the cost of borrowing to buy a house falls, due to the increased saving required to purchase the now-optimal larger house.*

Suppose that the U.S. switched to the Japanese tax system in that interest income is tax-exempt and mortgage interest payments are not tax deductible. In this case the model predicts that the saving rate would increase by one percentage point.

Simulation experiments are then conducted for the Japanese case in order to answer questions symmetric to the U.S. experiments: How much would the high Japanese saving rate be reduced if the tax exempt saving system is abolished? Would the typical Japanese tenure choice pattern be affected by the favorable tax treatment on mortgage payments, like in the United States? What would be the combined effect, i.e. if Japan switched to the U.S. tax system?

The first question is quite relevant since the Japanese government is currently considering abolishing the tax exempt status on certain interest income (the "maru-yu" accounts). The second question is also relevant, since adopting a more favorable tax treatment of mortgage payments is always proposed when housing problems are discussed in Japan. The presumption is that the housing stock is one are of comparative disadvantage for Japan compared to the U.S.

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* Remember that a liquidity constraints equivalent to a ban on borrowing in excess of housing capital is imposed in the model. Therefore, tax incentives for borrowing will not increase the demand for the composite consumption good during the first period, when the liquidity constraint is binding. If our focus is shifted from the downpayment constraint to borrowing constraints for consumption, we could investigate the effect of eliminating the tax deductibility of interest payments on consumer loans. In this case elimination could raise the saving rate.

The model predicts that abolition of the "maru-yu" accounts in Japan would cause a drop in the saving rate by two to three percentage points (depending on how strong the bequest motive is). The housing tenure pattern would also change, so that the Japanese would rent 10 more years before purchasing a house.

If Japan were to introduce tax-deductibility of mortgage interest payments, then the model predicts a very slight increase in the aggregate saving rate, without changing the tenure choice pattern. If Japan adopts the U.S. tax system with respect to interest income and interest payments, then the model predicts a drop in the saving rate of 2 percentage points if the bequest motive is strong, or by 3 percentage points, if there are no bequests.

The tax-exempt status of interest income has a stronger impact on the saving rate than the tax-deductibility of mortgage interest payments in both countries. The latter does not change the aggregate saving rate more than 50 basis points in any case in either country. Simulation results indicate that differences in the tax incentives between the two countries explain only one to three percentage points out of the 10 percentage point gap between the saving rates of the two countries.

6. Concluding Remarks

We constructed a simulation model in order to evaluate the effects of changes in housing finance institutions and tax policy on the housing tenure and the saving rate. Simulation results suggest that the factors do not offer a complete explanation of the large gap in the saving rate between the two countries. There are two reasons behind this conclusion. First, although the typical downpayment

ratio varies across the two countries, the variation is not sufficient to affect the aggregate saving rate by a significant amount. Second, tax reform experiments indicate that only one to three percentage points out of the 10 point gap is attributable to the difference in the tax incentives.

The model suggests that the difference in the income growth rate over generations can explain a greater amount of the saving rate gap. Given the difference in the income growth rates, we suspect also that the Japanese have a stronger bequest motive, perhaps due to their extended family relationships. The actual saving rate is reproduced in the model if the benefactor is planning to leave three times as much as their first-period income.

As is true for all numerical simulation analyses, the quantitative results presented here depend on our choices about the specification of the model. Several aspects of this specification are especially worthy of note. The use of a log linear utility function implies an intertemporal and intratemporal elasticity of substitution equal to one. This is likely to overstate the actual degree of substitutability, and thus understate the welfare cost of a given distortion in saving/consumption patterns. For example, with less intertemporal substitutability, an increase in the required down payment ratio is more likely to cause a household to postpone and reduce the size of a housing purchase, rather than have to reduce consumption early in the lifecycle.

The six-period formulation is also rather arbitrary and allows the consideration of only large discrete changes in the lifetime tenure pattern. A model with more periods would be able to treat the more continuous adjustment of tenure patterns in response to a change

in the economic environment. The cost of such a model is, of course, the increased computational expense.

Finally, an improved model would more carefully treat the bequest motive and, in general, transactions between generations. Differences in these transactions between the U.S. and Japan potentially play a large role in the determination of housing decisions and saving decisions as well as the effect of tax policy and other institutional arrangements on these decisions.

In spite of these qualifications, we believe that this analysis represents a valuable contribution to the quantitative analysis of the interaction of housing market institutions, tax policy, and savings behavior in the U.S. and Japan. It has demonstrated the importance of treating demand for housing and savings behavior simultaneously within the context of a dynamic model.

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TABLE 5-1

Banchmark Parameter values: Stylized Facts

	P_h	R	τ^r	τ	d	Mortgage maturity	Aggregate saving rate	Tenure choice
U.S.	1.95	0.5	0.3	0.3	0.25	30 yrs.	8.0%	R O O O O R
Japan	5.29	0.5	0.3	0.0	0.35	20 yrs.	18.29%	R R O O O R

* τ^r is the tax rate on rental income.
* τ is the tax rate on savings on financial assets.
* R: Rent
* O: Own

Stylized Facts: Cross-section income pattern at period t:

	$y_t(1)$	$y_t(2)$	$y_t(3)$	$y_t(4)$	$y_t(5)$	$y_t(6)$	g	n
U.S.	0.169	0.248	0.257	0.218	0.108	0.000	0.10	0.20
Japan	0.090	0.220	0.280	0.290	0.130	0.000	0.40	0.13

Banchmark Parameter values: Assumptions

	α	β	P_r	γ	q
U.S.	0.15	0.75	R	1.4	0.0
Japan	0.15	0.75	$R(1-\tau^r)$	1.4	0.0 or 3.0

TABLE 5-2

	Benchmark Theoretical Prediction						Facts*
U.S. no bequest (q=0)							
Tenure pattern	R	O	O	O	O	R	R O O O O R
Labor income profile*	.169	.273	.311	.290	.158	.000	
Aggregate saving rate				8.81%			8.0%
Wealth/Income**				2.7			
Housing/Wealth***				.74			
Japan no bequest (q=0)							
Tenure pattern	R	R	O	O	O	R	R R O O O R
Labor income profile	.090	.308	.549	.796	.499	.000	
Aggregate saving rate				11.16%			18.29%
Wealth/Income				2.4			
Housing/Wealth				.57			
Japan with bequest (q=3)							
Tenure pattern	R	R	O	O	O	R	R R O O O R
Labor income profile	.090	.308	.549	.796	.499	.000	
Aggregate saving rate				17.38%			18.29%
Wealth/Income				3.3			
Housing/Wealth				.40			

* The labor income and saving rate profile is a life-time labor income stream of a typical agent in the model. The profiles are calculated as longitudinal predictions, while the aggregate saving rate is a cross-section prediction.

** Wealth is the sum of financial assets and housing equity (value minus outstanding mortgage). Income in this table is measured on an annual basis.

*** The value of land is not included in the measure of housing or the measure of wealth. The observed housing/wealth ratio is indeed higher in the United States than in Japan, as suggested by this simulation table. However, the ratio of land value to wealth is much higher in Japan than in the United States. See also footnote 2 in the text.

TABLE 5-3

Downpayment ratio

U.S. (no bequest)

	25%	30%	35%	40%
T	R O O O O R	R O O O O R	R O O O O R	R R O O O R
S	8.81%	9.03%	9.22%	8.21%
W/I	.27	.27	.28	.28
H/W	..74	.70	.66	.84

JAPAN (no bequest)

7.5%	25%	30%	35%	40%
T R O O O O R	R R O O O R	R R O O O R	R R O O O R	R R O O O R
S 8.90%	10.72%	10.95%	11.16%	11.35%
W/I .19	.23	.23	.24	.24
H/W .77	.63	.60	.57	.54

JAPAN (bequest, q=3)

7.5%	25%	30%	35%	40%
T R O O O O R	R R O O O R	R R O O O R	R R O O O R	R R O O O R
S 15.32%	16.97%	17.19%	17.38%	17.55%
W/I .28	.32	.32	.33	.33
H/W .50	.43	.41	.40	.38

TABLE 5-4

Effects of Tax Reforms on the Saving Rate

Country: U.S.:
using U.S. parameters and income profiles

Tax treatment	#1	#2 (JAPAN)	#3 US status quo	#4
Interest income tax exempt?	YES	YES	NO	NO
Interest payment tax deductible?	YES	NO	YES	NO
Tenure choice	R O O O O R	R O O O O R	R O O O O R	R O O O O R
Aggregate saving	10.27%	9.94%	8.81%	8.43%

Country: Japan: no bequest
using Japanese parameters and income profiles

Tax treatment	#1	#2 JAPAN status quo	#3 (US)	#4
Interest income tax exempt?	YES	YES	NO	NO
Interest payment tax deductible?	YES	NO	YES	NO
Tenure choice	R R O O O R	R R O O O R	R R R O O R	R R R O O R
Aggregate saving	11.56%	11.16%	8.35%	8.07%

Country: Japan: bequest, q=3
using Japanese parameters and income profiles

Tax treatment	#1	#2 JAPAN status quo	#3 (US)	#4
Interest income tax exempt?	YES	YES	NO	NO
Interest payment tax deductible?	YES	NO	YES	NO
Tenure choice	R R O O O R	R R O O O R	R R R O O R	R R R O O R
Aggregate saving	17.74%	17.38%	15.47%	15.22%