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HOUSING TAX POLICY AND HONEOWNER MOBILITY

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ABSTRACT

This paper develops a model of "trading up" which accommodates the consumption and investment aspects of homeownership within an intertemporal framework, and which also incorporates a detailed description of the provisions of housing taxation.

Numerical simulations suggest that the optimal timing of trading up is anticipated and both intertemporal utility and the value of uptrading are reduced under either the elimination of mortgage and property tax deductibility, or the taxation imputed rental income. However, the elimination of the deductibility of mortgage interest payments has the largest effects in terms of trading up as well as utility losses and the reductions in the value of uptrading. In turn, the taxation of housing capital gains may delay the optimal timing of uptrading.

Under the different policy scenarios there is a possibility that policy changes will lock-in homeowners at their current home. In fact, while the intertemporal utility from uptrading is, under the status quo, well above the utility derived from staying at the current home, under the alternative scenarios the utility differential is dramatically reduced. For example, even though inflation and housing appreciation tend to have a positive effect on the value of uptrading under the current tax system, excessive inflation and excessively high real mortgage interest rates may lock-in homeowners at their current home.

HOUSING TAX POLICY AND HOMEOWNER MOBILITY

1. Introduction

The objective of this paper is to study the effects of the different provisions in the taxation of housing upon the intra-metropolitan homeowner mobility. The motivation for this paper comes from several empirical observations. First, residential mobility rates for homeowners rose sharply during the 1970's and then fell sharply after 1980. In the same period, mobility rates for renters were relatively stable. Second, mobility rates for young homeowners fell dramatically after 1980, though mobility rates for young renters were stable. Finally, the ratio of new home value to previous home value for recent home buyers dropped in the early 1980's, compared to the late 1970's.

In a previous paper Nakagami-Pereira (1989) we presented a model of the optimal timing of trading up, which considers consumption and investment motives of homeownership. One conjecture was that rapid housing appreciation enabled homeowners to accumulate the equity required to trade up to a more variable house more quickly than when housing prices are stable. The incentive for homeowners to maximize their financial leverage also is enhanced by the expectation of future capital gains. An additional conjecture was that rises in mortgage interest rates negatively affected the incentive to trade up. Analytical and simulation results showed that, in fact, macroeconomic variables, such as residential appreciation and mortgage interest rates, play an important role in the determination of both the optimal timing of trading up and homeowners' welfare.

By the federal tax law, under certain circumstances, the full value of mortgage interest payments is deductible from the personal income tax base. Property taxes are also deductible from taxable income. Second, the imputed rental income of homeownership is not taxable, that is, owner-occupants do not have to report the imputed income they earn from living in their own

houses. Third, owner-occupants can in most cases avoid capital gain taxation. Therefore, the tax rate on capital gains for owner-occupied housing is considered to be zero. In this paper we examine how housing tax policies impact the optimal timing of trading up, homeowners' welfare, and the value of uptrading. Also, the pure effects of residential appreciation and high inflation rates on residential mobility and household welfare are compounded by the special features of the current tax system, namely the deductibilities of nominal mortgage interest and property tax.

The effect of housing tax policy on housing decisions has focused on housing demand and tenure choice. A literature has developed to study the relationship between inflation and the user cost of housing services for homeowners. It is shown that the user cost of housing services for a homeowner declined, due to federal tax code, in the late 1970's when the inflation rate was very high. Therefore, an increase in housing demand is induced by a decrease in the user cost of housing services due to increased inflation [See Diamond (1980), Hendershott (1980), Dougherty-Van Order (1982), and Hendershott-Hu (1981) for example]. Second, housing taxation affects differently the user costs of housing services for homeowners and renters. The relative cost of renting versus owning has been regarded as an important factor for tenure choice and housing demand. It is shown that federal tax code contributed to an increase in the homeownership rate. [Rosen-Rosen (1980) and Hedershott-Shilling (1982) for example focus on tenure choice while Rosen (1979), King (1980), Gillingham-Hagemann (1983), and Henderson-Ioannides (1983) focus on the simultaneous decision of tenure choice and housing demand.] Third, once housing decisions are examined within an intertemporal framework, financial aspects (such as "financial tilt" due to high inflation), down-payment constraint, and mortgage payment constraint, become an important problem. The cash-flow effect might dominate the tax effect during an inflationary period and affect housing consumption negatively, especially for first homeowners [See Kearl (1979), Follain (1982), Alm and Follain (1982), and Schwab (1982) for example].

Considering that adjustments of housing consumption for homeowners are mostly induced by moving, it is important to investigate the effect of housing tax policies on homeowner mobility. This paper develops a simulation model of "trading up" which accommodates the consumption and

investment aspects of homeownership within an intertemporal framework, and which also incorporates a detailed description of the provision for housing taxation.

Simulations suggest that the elimination of mortgage deductibility, the taxation imputed rental income, and the elimination of property tax deductibility have qualitatively the same effects on the optimal timing of trading up, the maximized intertemporal utility, and the optimal size of housing. The optimal timing of trading up is anticipated and both intertemporal utility and the value of uptrading are reduced under the different policy changes. However, the elimination of the deductibility of the mortgage interest payments has the largest effects in terms of earlier trade ups as well as utility losses and reductions in the value of uptrading. In turn, the taxation of housing capital gains may delay the optimal timing of uptrading. Since the taxation of capital gains is equivalent to a reduction in the equity of the currently owned home, it may be optimal for the household to wait longer and accumulate more equity on the current home before uptrading.

Under the different policy scenarios there is a possibility that policy changes will lock-in homeowners at their current home. In fact, while the intertemporal utility from uptrading is, under the status quo, well above the utility derived from staying at the current home, under the alternative scenarios the utility differential is dramatically reduced. For some configurations of the simulations, the non-optimality of trading up is a distinct possibility. For example, even though inflation and housing appreciation tend to have a positive effect on the value of uptrading under the current tax system, excessive inflation deteriorates intertemporal utility to a point that homeowners could be locked-in at the current home. Also, excessively high real mortgage interest rates lock-in homeowners at the current home.

This paper is organized as follows. Section 2 develops the model of trading up. Section 3 presents the simulation results for changes in housing tax policy. In particular, we consider the elimination of the deductibility of the mortgage interest payments, the taxation of imputed rental income at the personal income tax level, the elimination of the property tax deduction, and the introduction of an effective capital gain tax on the sale of housing property. In turn, Section 4 investigates the effects of inflation and housing appreciation as well as changes in the real

mortgage interest rates. Finally, Section 5 summarizes the main results and provides direction for future work.

2. A Model of Trading-up

In this section, we develop a model of "trading up" which is designed to analyze the effects of housing taxation and inflation on the optimal timing of "trading up", housing demand, and homeowners' welfare.

In period 1, the household purchases a house for $P_H(1)H_0$, where H represents the number of "standardized housing units" and $P_H(1)$represents the purchase price per unit. We assume that the house does not depreciate, while the per unit housing price may change. The household spends all its accumulated savings on the down-payment home and borrows $bP_H(1)H_0$, where b is the exogenous fraction of the purchase price that is mortgage financed, at the fixed nominal mortgage interest rate i_0 (which is the sum of real mortgage interest rate r_0 and the inflation rate π). The mortgage must be paid off from 1 to T. We assume for simplicity that T coincides with the full maturity of the mortgage loan.

The constant yearly payment, implied by the mortgage payment, includes mortgage interest and principal retirement. It is denoted by v_0 and is given by:

$$(1) \quad bP_H(1)H_0=\Sigma_{1\le s\le T}\ v_0/(1+i_0)^s$$

where v_0 is the nominally constant mortgage payment. Therefore, the constant mortgage payment can be rewritten as:

$$(2) \quad v_0=bP_H(1)H_0/\Sigma_{1\le s\le T}\ [1/(1+i_0)]^s$$

Let $M_0(s)$ be the remaining principal of the first home at time s. $M_0(s)$ is determined as follows:

$$(3) \quad M_0(s)=(1+I_0)M_0(s-1)-v_0 \qquad (s=2,\ldots,t+1)$$

with initial condition $M_0(1)=bP_H(1)H_0$. In other words, the equity value of the first home at time s, denoted by $A_0(s)$, can be rewitten as:

$$(4) \quad A_0(s)=P_H(s)H_0-M_0(s) \qquad (s=1, \ ,t+1)$$

Suppose now, that at some t, the household decides to sell the first home and purchases a more valuable house. The sale of the first home is subject to capital gains tax at a rate of t_c. In general, capital gain taxes are assumed to be zero. On the other hand, a constant fraction of the purchasing price of second home a, is spent on transaction costs. We assume that the money, received by the household upon the sale of the first home, net of transaction costs and capital gain taxes is spent on the down-payment on the new home. Therefore, the size of the second home is determined by the down-payment constraint:

$$(5) \quad (1-b+a)P_H(t+1)H_1=A_0(t+1)-t_c(P_H(t+1)-P_H(1))H_0$$

The nominally constant mortgage payment for the second home, denoted by v_1, can be expressed as:

$$(6) \quad v_1=bP_H(t+1)H_1/\Sigma_{t+1\le s\le T+t}[1/(1+i)]^s$$

where i represents current fixed nominal mortgage interest rate. The remaining principal of the second home at time s, denoted by $M_1(s)$, is determined by the following equation:

$$(7) \quad M_1(s)=(1+i)M_1(s-1)-v_1 \qquad (s=t+2,\ldots,T+1)$$

with initial condition $M_1(t+1)=bP_H(t+1)H_1=(b/1-b+a)A_0(t+1)$. In other words, the equity value of the second home at time s, denoted by $A_1(s)$, can be rewritten as:

$$(8) \quad A_1(s)=P_H(s)H_1-M_1(s) \qquad (s=t+1,\ldots,T+1)$$

Let us now suppose that Y(s) indicates yearly income at time s, while C(s) indicates non-housing consumption and P(s) is the price of non-housing consumption. Since we assume that housing is the only relevant asset, the households face a sequence of budget constraints which can be written as:

$$(9) \quad Y(s)=P(s)C(s)+v_0+t_pP_H(s)H_0+t_Y[Y(s)+IMP_0(s)-DED_0(s)] \qquad (s=1,\ldots,t)$$

$$(10) \quad Y(s)=P(s)C(s)+v_1+t_pP_H(s)H_1+t_Y[Y(s)+IMP_1(s)-DED_1(s)] \qquad (s=t+1,\ldots,T)$$

where

$$(11) \quad DED_0(s)=i_0M_0(s)+t_pP_H(s)H_0$$

$$(12) \quad DED_1(s)=iM_1(s)+t_pP_H(s)H_1$$

$$(13) \quad IMP_0(s)=((1-t_Y)(i_0+t_p)-\pi_H)P_H(s)H_0$$

$$(14) \quad IMP_1(s)=((1-t_Y)(i+t_p)-\pi_H)P_H(s)H_1$$

Equations (10)-(14) reflect different aspects of the federal tax code. First, the full values of mortgage interest and property taxes are deductible from the personal income tax base. DED(s) as in (11)-(12) represent the deductible amount of mortgage interest and property taxes at time s, where t_p is the property tax rate. Second, the imputed rental income of homeownership is not taxable. IMP(s) as in (13)-(14) represent the imputed rental income of homeownership. The imputed rental income is calculated by multiplying housing price by the user cost of housing services. Recall that housing depreciation and maintenance are not considered in this model.

At t household's utility function is defined as $U_t(C,H)$ which is assumed to be twice continuously differentiable and well-behaved in that it satisfies both nonsatiation and strict concavity in X and H. The intertemporal stream of utility is generated by the aggregation of the time-separable, time-invariant utility function U(C,H).

At T, household's utility from terminal wealth is defined as $V(RA_1(T+1))$, where $RA_1(T+1)$ is the real terminal wealth measured in constant dollars, i.e.,

$$(15) \quad RA_1(T+1)=A_1(T+1)/(1+\pi)^T$$

and V(.) is assumed to be a monotonic increasing and strictly concave function.

The decision as of the optimal timing of trading up is related to the characteristics of housing as a consumption good as well as an investment good. First, households derive utility from the use of housing services, as reflected in their utility function. According to a pure consumption motive, trading up is induced by the trade-off between housing services and non-housing goods. Second, the model recognizes that the value of the housing stock at terminal time should be consistent with maximized utility in the terminal stage. According to a pure investment motive, trading up is induced by the maximization of the value of the housing stock at T.

The household decision problem consists on determining when (and if) to trade up. The timing of trading up is obtained from the constrained maximization of its intertemporal utility. The household's problem may be written as follows:

$$\max_{\{t\}} \beta[\Sigma_{1\le s\le t} U_s(C(s),H_0)/(1+\partial)^{s-1}+\Sigma_{t+1\le s\le T} U_s(C(s),H_1)/(1+\partial)^{s-1}]$$
$$+(1-\beta)[(1/(1+\partial))^T V(RA_1(T+1))]$$

subject to

(i) budget constraints

$$Y(s)=P(s)C(s)+v_0+t_p P_H(s)H_0+t_y[Y(s)+IMP_0(s)-DED_0(s)] \qquad (s=1,\ldots,t)$$

$$Y(s)=P(s)C(s)+v_1+t_p P_H(s)H_1+t_y[Y(s)+IMP_1(s)-DED_1(s)] \qquad (s=t+1,\ldots,T)$$

where

$DED_0(s)=i_0M_0(s)+t_pP_H(s)H_0$

$DED_1(s)=iM_1(s)+t_pP_H(s)H_1$

$IMP_0(s)=((1-t_y)(i+t_p)-\pi_H)P_H(s)H_0$

$IMP_1(s)=((1-t_y)(i+t_p)-\pi_H)P_H(s)H_1$

(ii) down-payment constraint for the purchase of first home

$S_0=(1-b)P_H(1)H_0$

(iii) down-payment constraint for the purchase of second home

$A_0(t+1)=(1-b+a)P_H(t+1)H_1$

(iv) terminal wealth in terms of dollars in base year

$RA_1(T+1)=A_1(T+1)/(1+\pi)^T$

In this optimization problem, parameter β indicates the relative degree of importance of the consumption and investment motives in household decisions. As β approaches one (zero), the consumption (investment) motive will become more important relative to the investment (consumption) motive. Also, this optimization problem presumes that the down-payment constraints are always binding while the mortgage constraints are never binding. Finally, the model is consistent with the behavior of both current homeowners, who already own a house and expect to trade it up at some point in the future, and first-time home buyers, who are currently in the process of buying their first house and equally expect to trade it up. The essential difference is that first-time home buyers lack initial housing equity and are therefore fully exposed to changes in housing prices. Also, tax changes are going to affect both current and future housing purchases while current homeowners have locked-in the tax benefits in their current property.

In order to examine the effects of housing taxation on housing decisions such as the optimal timing of "trading up", housing demand, and homeowners' welfare, we perform numerical simulation analysis. In fact, the optimization problem in this paper is too complex to be tackled

analytically in an insightful way. For the simulations, we assume that the yearly income of our stylized household is $20,000. Income is assumed to increase at a constant rate $g+\pi$, where g indicates the real rate of growth. The household's initial accumulated savings are $8,000. Since all the initial savings are spent on the down-payment and given a loan-to-value ratio b of .8, the down-payment constraint implies that the affordable housing for this household is valued at $40,000 for a standardized initial housing size of one unit. Also, the real mortgage interest rate is 3% and the inflation rate π, is 3% in the base case, while the rate of time preference is uniformly set at 3%.

The utility function is of the same form as in Dolde (1978), Schwab (1982), and Alm-Follain (1982). The utility function is assumed to be separable in housing and non-housing goods with a constant elasticity of substitution:

$$(16) \quad U=\Sigma_{t=1}^{T}(-C_t^{-\theta 1}-a_2 H_t^{-\theta 1})/(1+\partial)^{t-1}$$

The parameters a_1 and a_1 are set at .05 and .15, respectively.

In turn, the utility function from terminal wealth is given by:

$$(17) \quad V=-a_3 RA_1(T+1)^{-\theta 1}/(1+\partial)^{30}$$

where a_3 = .15 represents the marginal utility of terminal wealth.

Table 1 provides a full description of the parameters in this model as well as their values in the base case in the numerical simulations. In the base case, if households are motivated solely by consumption considerations, the optimal timing for trading up, the optimal size of the new house, and the intertemporal utility are the10th year, 1.680, and -15.285, respectively. In turn, if the households are motivated by investment considerations, the optimal timing for trading up, the optimal size of housing, and the terminal equity value in constant dollars are the 15th year, 2.126, and $54,220, respectively.

3. Simulation Results: Housing Taxation Policies

In this section, we investigate numerically the effects of changes in the major aspects of housing taxation on the optimal timing of "trading up", housing demand, and homeowners' welfare. In particular, we discuss the elimination of the deductibility of the mortgage interest payments, the taxation of imputed rental income at the personal income tax level, the elimination of the property tax deduction, and the introduction of an effective capital gain tax on the sale of housing property. In this section, the distinction between current homeowners and first-time home buyers is irrelevant, as long as the inflation rate and real mortgage interest rate are constant. The simulation results are summarized in Tables 2 and 3.

3.1. Elimination of the Deductibility of Mortgage Interest Payments

Under the current federal tax law nominal mortgage payments on housing are, with some qualifications, deductible from the personal income tax base. Recently, the possibility of eliminating, at least partially, this deduction has gained supporters in light of the current level of the federal budget deficits and the balanced budget provisions of the Gramm-Rudman-Hollings Bill. The possibility of eliminating this deduction is seen with major concern by the industry because of the negative effects it would have on the housing market. In this subsection we investigate the effects of eliminating the deductibility of mortgage interest payments on the optimal timing of trading up, housing demand, and homeowners' intertemporal utility (see Figure 1).

If the household is motivated solely by consumption considerations the elimination of the deductibility of mortgage interest payments anticipates the optimal timing of trading up from the tenth year to eighth year, while the maximized intertemporal utility is decreased. The optimal size of new housing is also decreased by 11.2%.

The elimination of the mortgage deductibility may lock-in current homeowners at the current home. In the base case, intertemporal utility from staying at the current home is well

below the utility with trading up. However, if the mortgage interest deductibility is eliminated, intertemporal utility from staying at the current home is still smaller but very close to the utility with trading up. While trading up is still optimal, it is easy to imagine more restrictive configurations of transaction costs that would render trading up non-optimal. The elimination of mortgage interest deductibility makes it more likely for homeowners not to trade up.

The elimination of the deductibility of mortgage interest affects non-housing consumption and housing consumption only through consumption motives. In fact, if the household is motivated solely by investment considerations the elimination of mortgage deductibility does not affect terminal wealth. For given evolution of prices and interest rates, terminal wealth depends essentially on the down-payment constraint. In the absence of intertemporal transfers of wealth and financial assets, this constraint is not affected by the elimination of mortgage deductibility. Accordingly, the optimal timing of trading up, the utility level from terminal wealth, and the optimal level of new housing size are not affected by the elimination of the deductiblity of mortgage interest payments.

Our simulation results show that, in general, eliminating the deductibility of mortgage interest anticipates the optimal timing of trading up, while the maximized intertemporal utility level and the value of uptrading are diminished. As in Poterba (1984), housing demand (the size of the second home)is decreased by eliminating the deductibility of mortgage interest. This fact suggests that the fears of the industry vis-a-vis this policy change, seem to be well founded. On the other hand, as in Slemrod (1982) homeowners' intertemporal utility level is decreased by the elimination of the deductibility of mortgage interest. Therefore, it seems that homeowners would also be advised to oppose the elimination of interest deductibility. In this paper we show further that the elimination of the deductibility of mortgage interest payments would anticipate the optimal timing of trading up. Houseseholds would tend to trade up earlier. The elimination of the deductibility of mortgage interest leads to a loss in non-housing consumption. Trading up earlier compensates this loss by providing a higher level of housing services.

3.2. Taxation of Imputed Rental Income

According to the Haig-Simons concept of income, imputed rental income from homeownership should be included in the personal income tax base. Despite the practical difficulties in calculating imputed rental income and the large administration costs, the adoption of the taxation of imputed rental income remains an important issue. In this subsection we investigate the effect of taxing the imputed rental income on the optimal timing of trading up, housing demand, and the level of homeowner's intertemporal utility (see Figure 2). If the household is motivated solely by consumption considerations, taxing imputed rental income anticipates the optimal timing of trading up from the tenth year to the ninth year, while the maximized intertemporal utility level is decreased, and the optimal size of housing is also decreased by 5.9%.

On the other hand, if the household is motivated by investment considerations, the optimal timing of trading up, the utility level from terminal wealth, and the optimal size of housing are not affected by taxing the imputed rental income. In fact, terminal wealth is not affected by taxing imputed rental income and the considerations made in the previous subsection apply here equally.

The simulation results show that imputed rental income tax speeds up the optimal timing of trading up. However, both the maximized intertemporal utility level and the value of trading up are decreased. As in Poterba (1984), taxation of imputed rental income depresses the stock of capital (value of uptrading). However, unlike in Hamilton and Whalley (1985), intertemporal utility for homeowners is reduced. Hamilton and Whalley examine the efficiency effects of the imputed rental income tax within a dynamic general equilibrium framework along the lines of Fullerton et. al (1983). They show that full taxation of imputed rental income appears to be a welfare improving change, since intertemporal effect, due to impute rental income tax, dominates its distortionary effect.

3.3 Deductibility of Property Tax

The property tax paid on owner-occupied housing is currently deductible from the personal income tax base. In this subsection, we investigate the effect of eliminating the deductibiltiy of property tax on the optimal timing of trading up, housing demand, and homeowner's intertemporal utility (see Figure 3). If the household is motivated solely by consumption considerations, eliminating the deductibiltiy of property tax slightly anticipates the optimal timing of trading up from tenth year to ninth year, while both the maximized intertemporal utility and the optimal size of the new house are slightly decreased.

If the household is motivated solely by investment considerations, terminal wealth is not affected by eliminating the deductibiltiy of property tax. Therefore, the optimal timing of trading up, the utility level from terminal wealth, and the optimal level of housing size are not affected by eliminating the deductibiltiy of property tax.

3.4 Taxation of Housing Capital Gains

Owner-occupants can, in most cases, avoid capital gains taxation. When homeowners sell their current home and buy another house of at least the same value within 18 months, capital gains are not taxed. Moreover, when homeowners are 55 years old or more, a one-time capital gain of up to $125,000 is excluded from capital gain taxation. Therefore, the tax rate on capital gains from owner-occupied housing is for practical purposes assumed to be zero. In this subsection, we investigate the effect of taxation of housing capital gain on the optimal timing of trading up, housing demand, and homeowners' intertemporal utility (see Figures 4 and 5). We consider two cases: the full capital gain taxes, i.e., the tax rate on capital gains is the same as the general personal income tax rate, and preferential capital gain taxes as the one that existed before the Tax Reform Act of 1986.

If the household is motivated solely by consumption considerations, capital gain taxation at full rate delays the optimal timing of trading up from tenth year to twelfth year, while the maximized intertemporal utility level is slightly decreased and the optimal size of the new house is decreased by 7.0%. Moreover, the higher the tax rate on capital gains, the further the delay in the optimal timing of trading up, and the lower the intertemporal utility level is.

If household is motivated solely by investment considerations, the taxation of capital gains anticipates slightly the optimal timing of trading up, and the optimal level of trading up is reduced by about 25%. Moreover, the full taxation of capital gain taxes shifts down terminal wealth by about 20%. Since the terminal wealth with uptrading is only marginally higher than if the household stays at the current home, taxation of capital gains coupled with a dominant investment motive may lock current homeowners in at the current home.

If both consumption and investment considerations are relevant, the taxation of capital gains decreases intertemporal utility level and the optimal level of uptrading. The global effect on the optimal timing of trading up is ambiguous in that consumption and investment motives work in opposite directions.

3.5 Comparative Analysis of the Different Policy Changes

The effects of the different policy changes are summarized in Figure 6. The elimination of mortgage deductibility, the taxation imputed rental income, and the elimination of property tax deductibility have qualitatively the same effects on the optimal timing of trading up, the maximized intertemporal utility, and the optimal size of housing. The optimal timing of trading up is anticipated and both intertemporal utility and the value of uptrading are reduced under the different policy changes. In fact, these changes affect the decision problem of our stylized household in the same way, via the budget constraint. All the changes are reflected in a lower after-tax income and therefore in reduced non-housing consumption. In neither case is terminal

wealth affected, which implies that policy changes are irrelevant for households with a dominant investment motive.

There are, however, important quantitative differences among the three cases. The elimination of the deductibility of the mortgage interest payments has the largest effects in terms of earlier trade ups as well as utility losses and reductions in the value of uptrading. In other words, the deductibility of the mortgage interest is dominant policy consideration for households' decisions. These results are consistent with Poterba (1984).

The taxation of housing capital gains has a direct impact upon uptrading via the down-payment constraint. Investment considerations are therefore relevant. Taxation of capital gains also affects utility from housing services in the sense that the value of uptrading is reduced under taxation. The critical assumption here is that all the money from the sale of the current house is used in the down-payment of the new house. No money is set apart to finance increased non-housing consumption.

The four policy changes under consideration have qualitatively similar impacts on intertemporal utility and the value of uptrading. However, taxation of housing capital gains may delay the optimal timing of uptrading while the other three policy changes always anticipate the timing of trading up. In fact, under capital gains taxation it may be optimal for the household to wait longer and accumulate more equity on the current house before uptrading. Notice that the taxation of capital gains is equivalent to a reduction in the equity of currently owned house. Under the other policy changes, early trade up gives the households earlier access to increased housing services that compensate the loss in non-housing consumption induced by the reduction in after-tax income.

Under all the scenarios there is a possibility that policy changes will lock-in homeowners at their current home. In fact, while the intertemporal utility from uptrading is, in the base case, well above the utility derived from staying at the current home, under the alternative scenarios the utility differential is dramatically reduced. For some configurations of transaction

costs, for example, the non-optimality of trading up is a distinct possibility. (A corner solution is possible since the objective function for our stylized household is not globally concave.)

From a policy point of view, simulations suggest that not only the deductibility of mortgage interest is by far the most important issue in the taxation of housing, but also that substantial negative effects in terms of household welfare and housing demand would follow the elimination of this provision. However, the analysis of the global effects of the elimination of deductibility of mortgage interest could only be pursued in a general equilibrium context and is therefore out of the scope of this paper.

4. Simulation Results: Inflation and Changes in the Mortgage Rates

The idea that high residential appreciation rates could induce homeowner mobility was explored in a previous paper, Nakagami-Pereira (1989). The simulation results in that paper suggested that inflation and residential appreciation tend to have a positive effect on housing demand of the new home and to anticipate the optimal timing of trading up. These results are consistent with the empirical evidence: mobility rates for homeowners went up during the 1970's when inflation rate was high and dropped off in the early 80's when inflation rates remained low. In this paper, the pure effects of residential appreciation and high inflation rates on residential mobility and household welfare are compounded by the special features of the current tax system. Residential appreciation and high inflation rates impact on residential mobility and household welfare also via the deductibilities of nominal mortgage interest and property tax.

In this section, we investigate the effects of inflation housing appreciation consistent with constant real interest rates as well as the effects of changes in real mortgage rates for constant infation. The simulation results are summarized in Tables 4 and 5.

4.1. Inflation, Housing Appreciation, and Homeowner Mobility

In this subsection, we investigate the effects of inflation on the optimal timing of trading up, homeowner's intertemporal utility, and housing demand (see Figures 7 and 8). An increase in inflation rate is assumed to imply a matching increase in nominal mortgage interest rates so that real mortgage interest rates are kept constant at 3%.

If the household is motivated solely by consumption considerations, the higher is the inflation rate, the earlier is the optimal timing of trading up. At 6% and 9%, the optimal timings of trading up are the seventh year and the fifth year, respectively. Also, the higher the inflation rate is, the lower the maximized intertemporal utility level is. In fact, for high levels of inflation, homeowners may be locked-in at their current houses. At 6%, the intertemporal utility from uptrading is still higher than from staying indefinitely in the current house: current homeowners still have an utility incentive to trade up. At 9% however, homeowners have no incentive to trade up in that intertemporal utility from uptrading is lower than the utility derived from staying indefinitely in the current house. Finally, the simulations show that inflation has a positive effect on housing demand (value of uptrade) by homeowners up to some level. The optimal sizes of the second home at 6% is up by 4% while at 9% is up by only 2.6%. After a certain inflation level the burden of higher nominal interest rates on mortgage interest rates becomes dominant.

If the household is motivated solely by investment considerations, the optimal timing trading up is slightly anticipated by an increase in inflation rate. In turn, terminal wealth is increased by a rise in inflation rate. At 9%, the terminal wealth in constant dollars is up by 65%. Finally, the higher inflation rate is, the larger is the optimal size of the new home. The optimal sizes of the new home at 6% and 9% are up by 20% and 32.5%, respectively.

4.2 Real Changes in Mortgage Interest Rates

In this subsection we focus on the effects of an increase in real mortgage interest rates from 3% to 6% (with constant inflation at 3%) on the optimal timing of trading up, housing demand, and homeowners' welfare with those of an increase in real mortgage interest rates. These effects are contrasted with the effects of an increase in the inflation rate with constant real mortgage interest rates.

If households are solely motivated by consumption considerations, an increase in real mortgage interest rates delays slightly the optimal timing of trading up. However, trading up is blocked by the fact that at 6%, the intertemporal utility from trading up is the same as the intertemporal utility from staying at the current home. There is no incentive for the household to trade up. The increase in the real mortgage interest rates locks-in homeowners at the current home. In general, the higher real mortgage interest rates are, the less incentive homeowners have to trade up. A definite consequence of the increase in real interest rates is a decrease in intertemporal utility for homeowners.

If households are solely motivated by investment considerations, the optimal timing of trading up is slightly anticipated by an increase in real mortgage rates. However, terminal wealth is decreased by about 6.5% and the optimal size of the second home is slightly decreased.

Notice that, if homeowners are motivated solely by consumption considerations, an increase in inflation rate to 6% (with nominal interest rates increased to 6%) anticipates the optimal timing of trading up, while a rise in real mortgage interest rate to 9% (with the nominal rate equally at 6%) tends to lock-in current homeowners at the current home. If homeowners are motivated solely by investment considerations, an increase in inflation rate increases the value of trading up and the terminal wealth, while a rise in real mortgage interest rates decreases both.

The differences in the results between housing appreciation and inflation on one hand and changes in real mortgage rates on the other hand, can be traced to the different fact that the latter

affects households decisions via the budget constraints and the mortgage payments, while the former only affects mortgage payments.

5. Summary and Concluding Remarks

Previous theoretical and empirical literature on homeowner mobility has focused on the consumption aspects of homeownership: life-cycle factors (including job change); the gap between actual and desired housing consumption; and changes in neighborhood quality. Recent empirical observations on housing appreciation, the evolution of mortgage rates, and homeowner mobility suggest that the investment aspect of homeownership must also be emphasized. On the other hand, the recent work on the investment component of housing decisions have examined tenure choice and the timing of tenure conversion form renting to owning, but omitted the issue of homeowners' mobility, and in particular the effect of housing tax policy in the phenomena of homeowner mobility. These two trends in the literature are brought together in this paper.

This paper develops a simulation model of "trading up" which accommodates the consumption and investment aspects of homeownership within an intertemporal framework, and which also incorporates a detailed description of the provision for housing taxation. Households determine the optimal timing of trading up and the value of trading up, taking into consideration the intertemporal utility of both housing and non-housing consumption as well as the ultimate equity value of their housing property.

Simulations suggest that the elimination of mortgage deductibility, the taxation imputed rental income, and the elimination of property tax deductibility have qualitatively the same effects on the optimal timing of trading up, the maximized intertemporal utility, and the optimal size of housing. The optimal timing of trading up is anticipated and both intertemporal utility and the value of uptrading are reduced under the different policy changes. However, the elimination of the deductibility of the mortgage interest payments has the largest effects in terms of earlier trade

ups as well as utility losses and reductions in the value of uptrading. In turn, the taxation of housing capital gains may delay the optimal timing of uptrading. Since the taxation of capital gains is equivalent to a reduction in the equity of currently owned house, it may be optimal for the household to wait longer and accumulate more equity on the current house before uptrading.

Under the different policy scenarios there is a possibility that policy changes will lock-in homeowners at their current home. In fact, while the intertemporal utility from uptrading is, under the status quo, well above the utility derived from staying at the current home, under the alternative scenarios the utility differential is dramatically reduced. For some configurations of the simulations, the non-optimality of trading up is a distinct possibility. For example, even though inflation and housing appreciation tend to have a positive effect on the value of uptrading, under the current tax system excessive inflation deteriorates intertemporal utility to a point that homeowners could be locked-in at the current home. Also, excessively high real mortgage interest rates lock-in homeowners at the current home.

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TABLE 1

DEFINITIONS

Variable	Definition	/BASE CASE/
U	Utility function	
$C(s)$	Non-housing consumption in period s	
H_0	Initial housing consumption	/1.0/
H_1	Housing consumption of second home	
∂	Rate of time preference	/0.03/
$P(1)$	Initial price of non-housing consumption goods	/1.0/
$P(s)$	Price of non-housing consumption in period s	
$PH(1)$	Initial price of housing consumption	/40,000/
$P_H(s)$	Price of housing consumption in period s	
S_0	Initial saving	/8,000/
$Y(1)$	Initial income	/20,000/
$Y(s)$	Income in period s	
π	Inflation rate	/0.03/
π_H	Nominal housing appreciation rate	/0.03/
π_Y	Income growth rate	/0.02/
r_0	Initial real mortgage interest rate	/0.03/
r	Real mortgage interest rate	/0.03/
i_0	Initial nominal mortgage interest rate	/0.06/
i	Nominal mortgage interest rate	/0.06/
$M_0(s)$	Remaining principal for first home in period s	
$M_1(s)$	Remaining principal for second home in period s	
v_0	Constant mortgage payment for first home	
v_1	Constant mortgage payment for second home	
$A_0(s)$	Equity of first home in period s	
$A_1(T+1)$	Terminal Equity of second home	
$RA_1(T+1)$	Terminal Equity in constant dollars	
$DED_0(s)$	Deduction for first home in period s	
$DED_1(s)$	Deduction for second home in period s	
$IMP_0(s)$	Imputed income of homeownership for first home in period s	
$IMP_1(s)$	Imputed income of homeownership for second home in period s	
ty	Income tax	/0.30/
tp	Property tax	/0.01/
tc	Capital gain tax	/0.00/
a	Transaction costs (%)	/0.10/
b	Fraction of mortgage	/0.80/

TABLE 2

EFFECTS OF CHANGES IN HOUSING TAXATION WHEN CONSUMPTION MOTIVE DOMINATES ($\beta=1$)

	t	H_I	U
MTG	-	-	-
IMP	-	-	-
PT	-	-	-
CAP	+	-	-

TABLE 3

EFFECTS OF CHANGES IN HOUSING TAXATION WHEN INVESTMENT MOTIVE DOMINATES ($\beta=0$)

	t	H_I	U
MTG	no change	no change	no change
IPM	no change	no change	no change
PT	no change	no change	no change
CAP	-	-	-

TABLE 4

EFFECTS OF INFLATION AND CHANGES IN REAL MORTGAGE INTEREST RATES WHEN CONSUMPTION MOTIVE DOMINATES ($\beta=1$)

	t	H_1	U
INF	-	+	-
r	lock-in	lock-in	-

TABLE 5

EFFECTS OF INFLATION AND CHANGES IN REAL MORTGAGE INTEREST RATES WHEN INVESTMENT MOTIVE DOMINATES ($\beta=0$)

	t	H_1	U
INF	- (slightly)	+	+
r	- (slightly)	no change	-

FIGURE 1
EFFECTS OF ELIMINATING MORTGAGE INTEREST DEDUCTIBILITY

UTILITY LEVEL FOR DIFFERENT TRADING-UP TIMING (β=1)

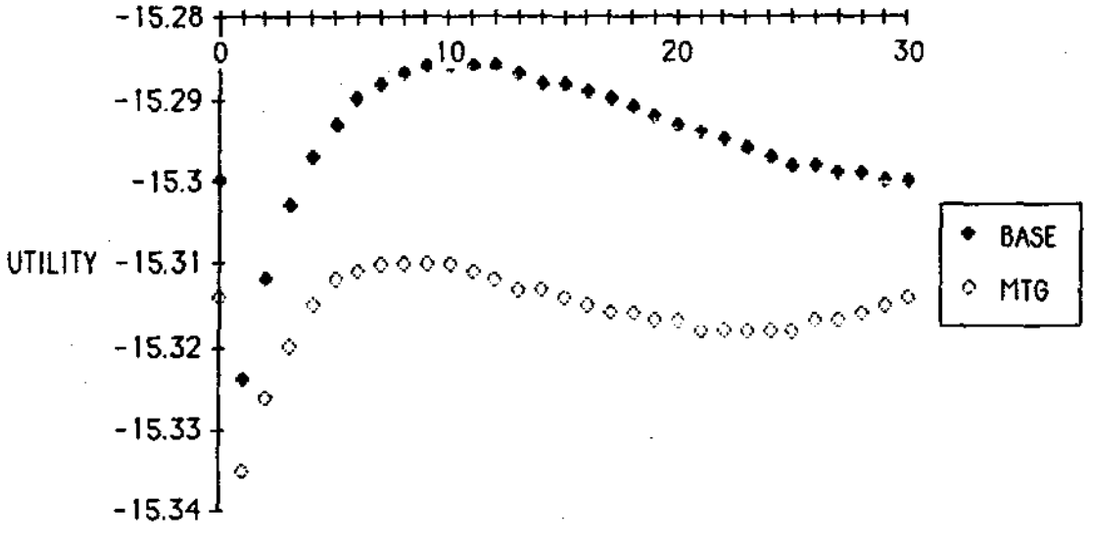

FIGURE 2
EFFECTS OF TAXATION ON IMPUTED RENTAL INCOME

UTILITY LEVEL FOR DIFFERENT TRADING-UP TIMING (β=1)

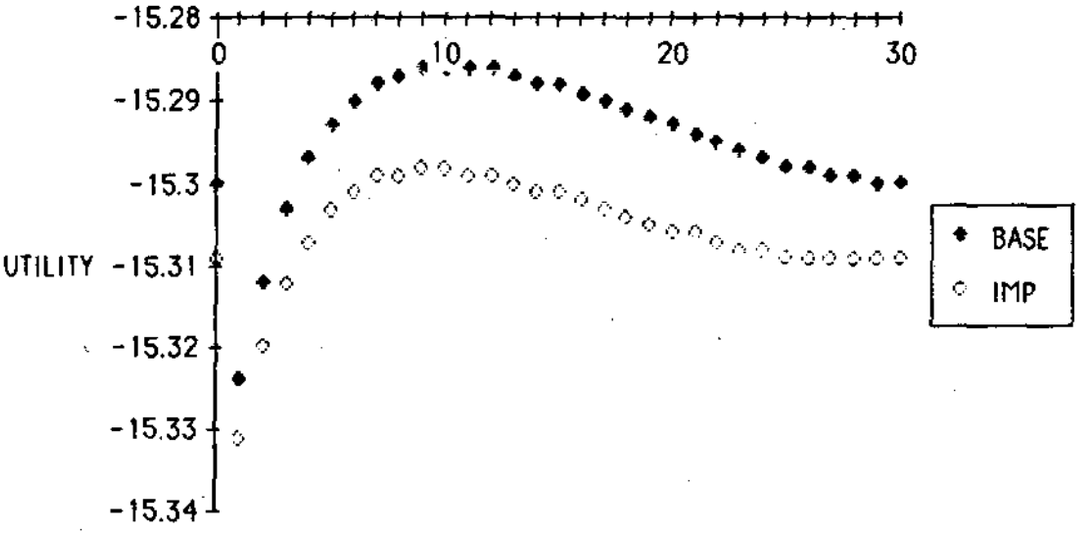

FIGURE 3
EFFECTS OF ELIMINATING THE DEDUCTIBILITY OF PROPERTY TAX

UTILITY LEVEL FOR DIFFERENT TRADING-UP TIMING (β=1)

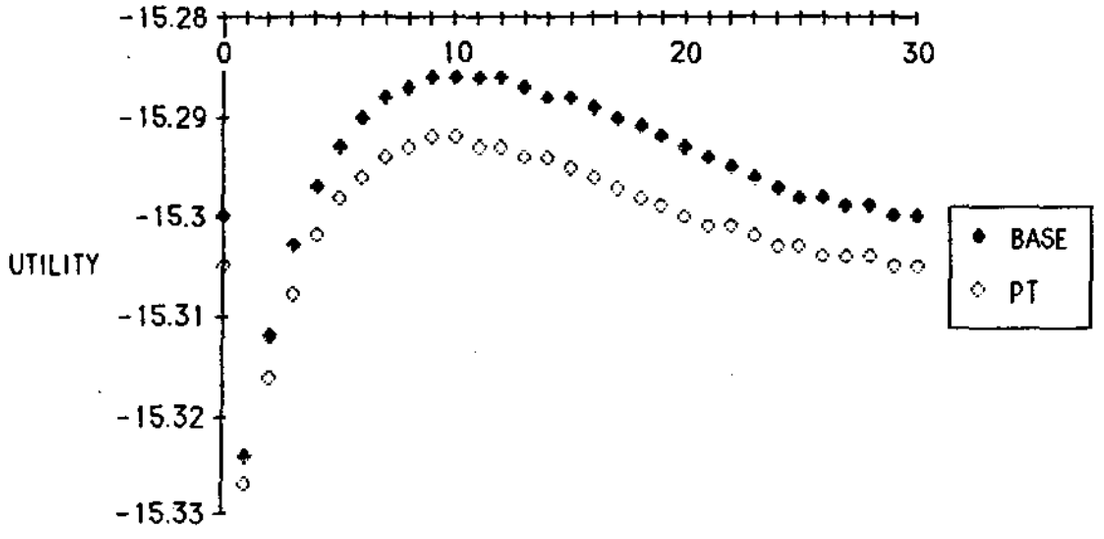

FIGURE 4
EFFECTS OF TAXATION OF CAPITAL GAINS

UTILITY LEVEL FOR DIFFERENT TRADING-UP TIMING (β=1)

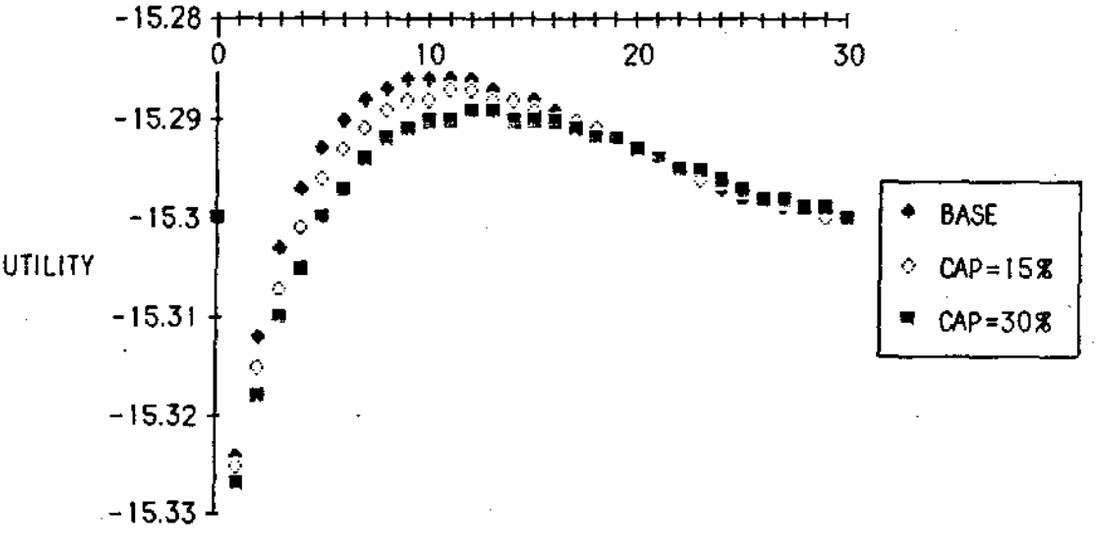

FIGURE 5
EFFECTS OF TAXATION ON CAPITAL GAINS

TERMINAL EQUITY FOR DIFFERENT TRADING-UP TIMING (β=0)

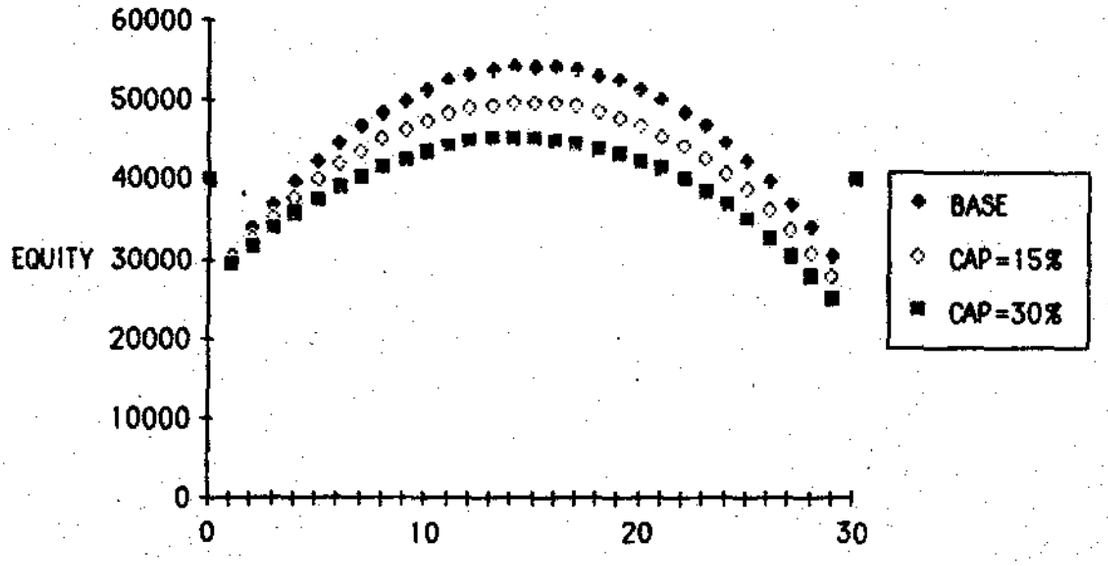

FIGURE 6
EFFECTS OF CHANGES IN HOUSING TAXATION

UTILITY LEVEL FOR DIFFERENT TRADING-UP TIMING (β=1)

FIGURE 7
EFFECTS OF INFLATION

UTILITY LEVEL FOR DIFFERENT TRADING-UP TIMING (β=1)

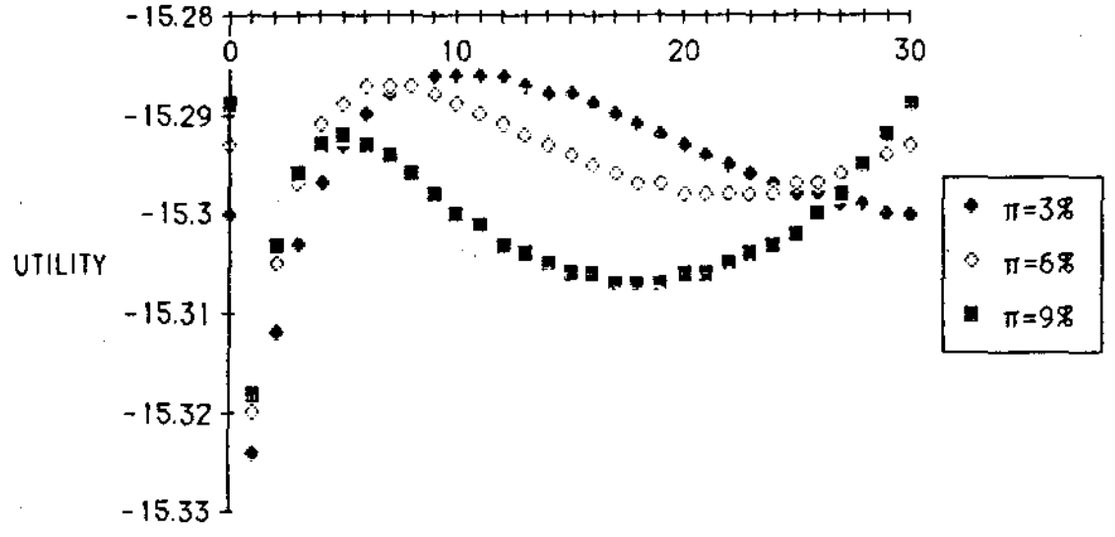

FIGURE 8
EFFECTS OF INFLATION

TERMINAL EQUITY FOR DIFFERENT TRADING-UP TIMING (β=0)

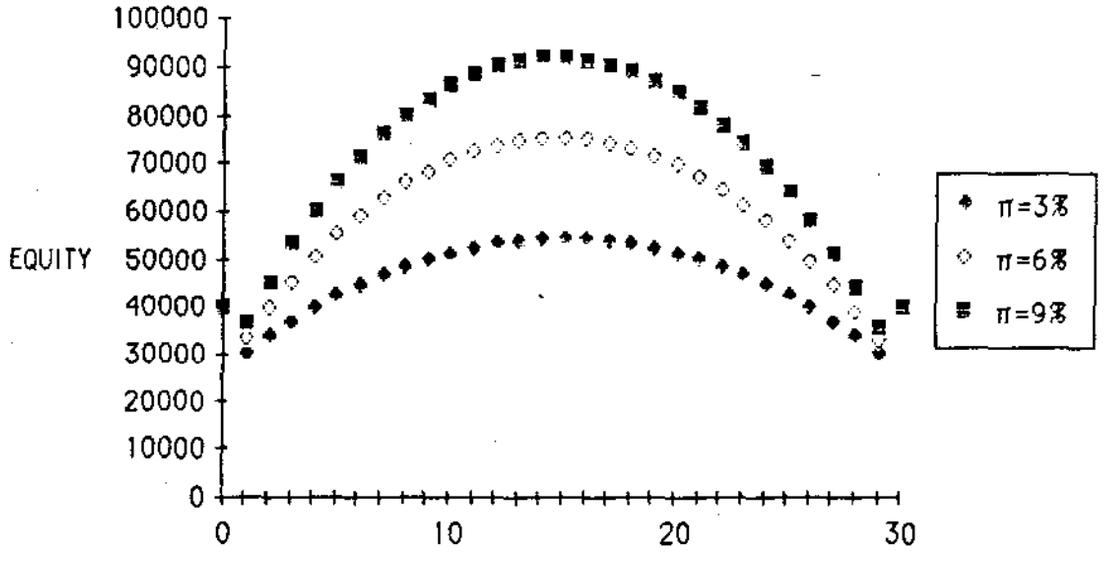

FIGURE 9

EFFECTS OF CHANGES IN REAL MORTGAGE INTEREST RATES

UTILITY LEVEL FOR DIFFERENT TRADING-UP TIMING (β=1)

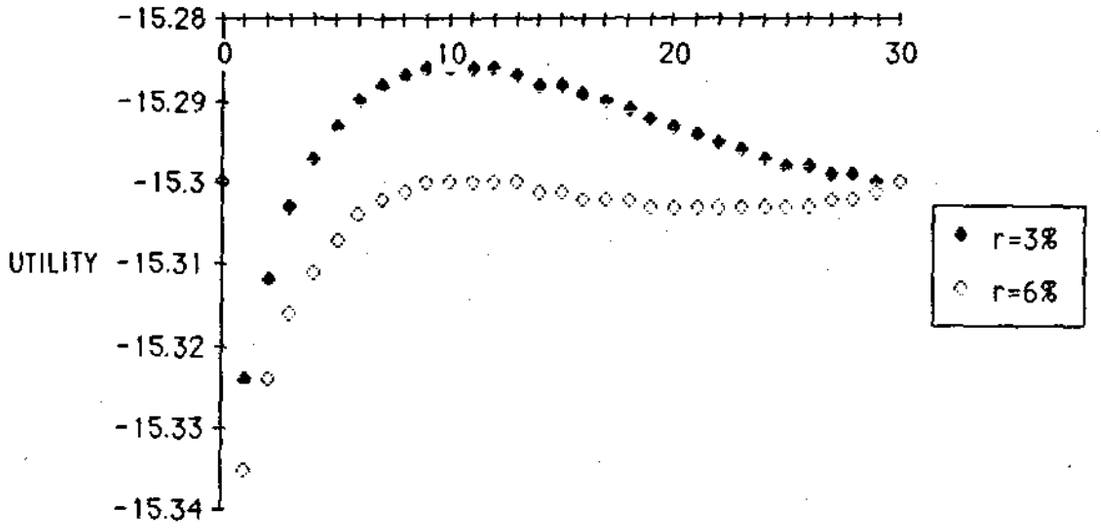

FIGURE 10

EFFECTS OF CHANGES IN REAL MORTGAGE INTEREST RATES

TERMINAL EQUITY FOR DIFFERENT TRADING-UP TIMING (β=0)