NBER WORKING PAPER SERIES

THE ALLOCATION OF CAPITAL BETWEEN RESIDENTIAL AND NONRESIDENTIAL USES: TAXES, INFLATION AND CAPITAL MARKET CONSTRAINTS

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Working Paper No. 718

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge MA 02138

July 1981

An earlier version of this paper was presented at the Ninth Annual Mid-Year Meeting of the AREUEA, May 27, 1981. Financial support from the National Science Foundation and discussions with Joel Slemrod regarding a number of issues involved in the construction of the basic model are gratefully acknowledged. The research reported here is part of the NBER's research program in Taxation and project on Capital Formation. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

NBER Working Paper #718
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ABSTRACT

We have constructed a simple two-sector model of the demand for housing and corporate capital. An increase in the inflation rate, with and without an increase in the risk premium on equities, was then simulated with a number of model variants. The model and simulation experiments illustrate both the tax bias in favor of housing (its initial average real user cost was 3 percentage points less than that for corporate capital) and the manner in which inflation magnifies it (the difference rises to 5 percentage points without an exogenous increase in real house prices and 4 percentage points with an exogenous increase). The existence of a capital-market constraint offsets the increase in the bias against corporate capital, but it introduces a sharp, inefficient reallocation of housing from less wealthy, constrained households to wealthy households who do not have gains on mortgages and are not financially constrained. Widespread usage of innovative housing finance instruments would overcome this reallocation but at the expense of corporate capital. Only a reduction in inflation or in the taxation of income from business capital will solve the problem of inefficient allocation of capital.

The simulation results are also able to provide an explanation for the failure of nominal interest rates to rise by a multiple of an increase in the inflation rate in a world with taxes. When the inflation rate alone was increased, the ratio of the increases in the risk-free and inflation rates was 1.32. An increase in the risk premium on equities, in conjunction with the increase in inflation, lowered the simulated ratio to 1.10, introduction of a supply price elasticity of 4 and an exogenous increase in the real house price reduced the ratio to 1.03, and incorporation of the credit-market constraint reduced the ratio to 0.95.

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During the past decade, the United States has been plagued by a declining rate of productivity growth. Many have attributed this phenomenon to a sharp slowdown in the growth of the capital/output ratio in the industrial sector, and others have advanced a wide variety of policies, under the broad umbrella of reindustrialization, to increase business investment and reverse the downward trend in productivity. Some policies are intended to promote savings and thus total capital formation. Others are designed to shift the composition of capital formation from residential to nonresidential. A primary rationale for the shift policies is the argument that the United States has overinvested in residential capital in the 1970s. More specifically, many have contended that the current tax system is biased in favor of residential capital and that this bias has been reinforced by the acceleration of inflation during the past decade and a half.[1] The bias takes the form of declining real user costs or investment hurdle rates for housing vis-a-vis business investment and results in households occupying housing units of too great quantity or quality.

In spite of this apparent bias, the composition of investment in the United States does not seem to have been altered significantly in favor of residential uses. In fact, the reverse appears to have occurred (see Grebler, 1979 and Feldstein, 1981). One explanation for this result is that factors other than the tax bias may have been operating to raise the share of nonresidential investment in total capital formation. Under this interpretation, the tax-inflation bias has simply acted to offset such factors. For example, if the income elasticity of the demand for housing is less than unity, then we would expect the share of housing in GNP to decline

[1] Diamond (1980) and Villani (1981) have documented the decline in the real user cost of owner-occupied housing; Hendershott and Hu (1980 and 1981b) have emphasized the decline relative to real user costs for nonresidential capital.

over time as real income grows. An alternative explanation is that the model underlying the derivation of the tax-inflation bias is misspecified. Two potential problems come to mind. First, the existence of fixed-rate mortgages and the capital gains earned on them during periods of rising interest rates might prevent optimizing households from changing (increasing) their effective housing demand even in the face of increasing tax advantages. Second, capital-market constraints (lender's restrictions on debt payment-income ratios) might significantly reduce the demand for housing by less wealthy households that move (in order to achieve real income gains) during periods of rising inflation and interest rates. Of course, if the effective demand for housing has not increased, then capital cannot have been reallocated away from industrial uses. A major goal of the present paper is to determine the extent to which the existence of capital gains on existing mortgages and capital-market constraints could have offset the effect of the inflation-induced relative decline in the real user cost of housing on the allocation of capital.

With this goal in mind, we have constructed a simple two-sector general-equilibrium simulation model of the demand for housing and corporate (nonhousing) capital.[2] The model incorporates the existing tax structure, introduces portfolio balance relations for households, specifies risk premiums required to hold risky assets, and includes a federal budget constraint whereby government spending moves with federal

[2]For theoretical analyses of the allocation of capital between residential and nonresidential uses, see Ballentine (1981), Ebrill and Possen (1980), and Kau and Kennan (1981). For a large scale general equilibrium simulation model incorporating financial behavior, see Slemrod (1981).

tax revenues. To allow for the operation of credit market constraints, households are partitioned into the wealthy who lend to the less wealthy. (Both groups of households finance business.) The model simultaneously determines the risk-free debt rate, risk premiums on mortgages, corporate equities and housing, and the allocation of a fixed capital stock among corporate capital, housing of the wealthy and housing of the less wealthy. The model is parameterized so as to make it roughly comparable to the American economy in the middle 1960s.

Sections III-V contain the results of a variety of simulation experiments. The basic experiment is an increase in the inflation rate from one to 8 percent, either alone or accompanied by an increase in the risk premium on corporate equities. The experiments are run with and without allowance for behavior influenced by capital gains on existing mortgages. Section IV introduces an endogenously-determined real housing price and a mechanism for incorporating an exogenous increase in the real housing price. The impact of a capital market constraint on housing demand of the less wealthy is developed in Section V. A summary concludes the paper.

I. The Model

Output and the Demands for Capital

Consider an economy in which there are two goods - housing and nonhousing. Housing services are produced by using only residential capital, and the nonhousing good is produced by nonresidential capital and labor via a Cobb-Douglas production function

$$(1) \qquad Y = \gamma_k K^{\alpha_k} L^{1-\alpha_k},$$

where Y is the level of nonhousing output; L is the labor force; and K is the quantity of nonresidential capital employed which is determined by equating the value of its after-tax marginal product to its user cost. That is,

$$(1-\tau)\gamma_k \alpha_k Y/K = c_k$$

or

$$(2) \qquad K = (1-\tau)\gamma_k \alpha_k Y/c_k ,$$

where τ is the corporate income tax rate, and c_k is the user cost of nonresidential capital.

Assume that each unit of housing capital produces one unit of housing services.[3] The quantity of housing services demanded by each household i is assumed to be unitary elastic with respect to the income of the household and ϵ elastic with respect to the implicit rents per unit of housing and thereby the user cost of housing capital. Assuming that there are n households with identical tastes in the economy, the individual housing demand equation is

[3]We make the simplifying assumption that no labor is employed in the production of housing services. Similarly, we assume that no capital is employed in the production of government services.

$$(3) \qquad H^i = \alpha_h D^i (c_h^i)^\epsilon$$

where H^i denotes the demand for housing services by the ith household; D^i its disposable income; and c_h^i the real user cost per unit of housing stock. As discussed below, c_h^i is household specific because of differences in income (and thus personal tax rates) and wealth (and thus portfolio compositions and risk premiums).

The total demand for housing is equal to ΣH^i. Assuming that there is perfect mobility of capital between residential and nonresidential uses, we can write

$$(4) \qquad W_r = K + \Sigma H^i$$

where K is the total demand for nonresidential capital as determined in equation (2), and W_r is the real stock of wealth of the economy and will be treated as a constant in the basic model. The total value of wealth, on the other hand, is equal to

$$(5) \qquad W = K + p\Sigma H^i ,$$

where p is the real price of housing (the ratio of the price of housing to the price of nonhousing goods, the latter being treated as the numeraire) and is initially unity so $W = W_r$. While all housing is assumed to be owned directly by households, K is assumed to be held by corporations which finance their investment by issuing bonds and equity (either directly or by retaining earnings).

Portfolio Balance and Risk Premiums

Household assets include corporate debt, corporate equity, and housing. Some wealthy households also hold mortgages issued by less wealthy homeowners. The balance sheet for each household i can be expressed by the following equation

$$(6) \qquad B^i + E^i + M^i + H^i = M_s^i + W^i,$$

where B^i, E^i, M^i and H^i are, respectively, the amounts of corporate debt, corporate equity, mortgage debt, and housing owned by the ith household, while W^i and M_s^i are the net worth and the mortgage debt incurred by it. For simplicity, the bonds are assumed to be risk-free (the return is certain). It seems reasonable to assume that mortgage suppliers are never holders of mortgages or corporate bonds. Thus for those households with positive B^i and M^i, M_s^i is equal to zero (their housing purchases are completely equity financed). On the other hand, for those having positive loan to value ratios, B^i and M^i are equal to zero.

With respect to the risky assets, the quantity of each demanded by household i relative to its total wealth is assumed to equal the ratio the difference between the rate of return on that asset and the risk-free rate to the product of the risk aversion parameter and the expected variance of the return on that asset:[4]

$$(7) \qquad \frac{I_j^i}{W^i} = \frac{r_{ja}^i - i_a^i}{R\sigma_j^i} \qquad \text{or}$$

[4] See Friend and Blume (1975) and Slemrod (1981). All covariances are assumed to be zero.

$$(7') \qquad r^i_{ja} = i^i_a + \rho^i_j$$

where i^i_a is the after-tax nominal return on the risk-free asset, I^i_j is the jth risky asset, r^i_{ja} is its after-tax expected nominal return and σ^i_j the expected standard deviation of this return, R is the common risk-aversion parameter and $\rho^i_j = R\sigma^i_j(I^i_j/W^i)$ is the risk premium required on the jth asset. Obviously the rates of return and standard deviations are after-tax and thus are household specific. Bond holdings and mortgage outstandings, respectively, are derived residually for wealthy and nonwealthy households as

$$(8) \qquad B^i = W^i - \Sigma I^i_j$$

$$(9) \qquad M^i_s = \Sigma I^i_j - W^i.$$

Corporations finance their capital by issuing bonds B and equity E. Assuming that average q is unity (B+E = K) and that b is the portion of corporate capital that is debt financed, we can write the market clearing equations as[5]

$$\Sigma B^i = B = bK$$

$$\Sigma E^i = E = (1-b)K$$

$$\Sigma M^i = \Sigma M^i_s \ .$$

It is heuristic to consider the case where there are only two types of households, the wealthy and the nonwealthy. For the wealthy, (6) reduces to

$$W^W = B + E^W + pH^W + M.$$

[5] Corporate financial behavior is treated as exogenous. Extrapolation from Slemrod's simulation experiments suggests that this will not significantly influence the results.

The corresponding balance sheet for the nonwealthy is

$$W^N = E^N + H^N - M .$$

Assuming further that these households are taxed at the same rate, they are faced with the same corporate equity and bond (risk-free) rates, and equation (7) implies that the ratio of E^i to W^i is the same for all i. Consequently

$$\frac{E^W}{W^W} = \frac{E^N}{W^N} = \frac{E}{W} = \frac{(1-b)K}{W} . \tag{10}$$

Thus $E^W = w(1-b)K$, where $w = W^W/W$ is the share of total wealth held by the wealthy household. Note also that $M = M_s$. Letting v be the loan-to-value ratio on housing investment by the nonwealthy households, this relationship can be further reduced to $M = vpH^N$. Thus we have

$$W^W = bK + w(1-b)K + pH^W + vpH^N \tag{11}$$

and

$$W^N = W - W^W . \tag{12}$$

The Real User Costs of Capital

We are now ready to detail the user costs of capital. Taking into account the deductibility of nominal interest cost, differences between tax and economic depreciation, and the differential taxation of earnings and capital gains, we can write the real user cost of corporate capital as

$$c_k = b(1-\tau)i + (1-b)r_k - \pi_k + \delta_k - \tau\delta_k^* + (1-\tau)\tau_k^p \tag{13}$$

where π_k is the expected rate of change in the price of corporate capital, δ_k is the true depreciation rate of capital, δ_k^* is the depreciation rate allowed by tax law and τ_k^p is the rate of property tax applied to corporate capital.[6] The nominal equity rate paid by corporations is r_k and differs from the after-tax equity rate received by shareholders, r_{ka}, by the taxes (at the personal level) on dividend income and on increases in share values resulting from retention of corporate earnings and inflation. Letting γ be the portion of real earnings (including real gains at the expense of debtors) paid out, θ be the common personal income tax rate and μ_k the capital gains tax rate, the relationship between r_{ka} and r_k is given by

$$(14) \qquad r_{ka} = \gamma(1-\theta)(r_k - \pi_k) + (1-\mu_k)[(1-\gamma)(r_k - \pi_k) + \pi_k]$$

$$= (1-x)r_k + \gamma(\theta - \mu_k)\pi_k ,$$

with $x = \gamma\theta + (1-\gamma)\mu_k$. Using equations (14), (7'), the definition of ρ, and (10), we have

$$(15) \qquad r_k = \frac{1-\theta}{1-x}i - \frac{\gamma(\theta-\mu_k)}{1-x}\pi_k + \frac{1-b}{1-x}\frac{R\sigma_E K}{W} .$$

Finally, the tax saving per unit of capital from depreciation can be expressed as

$$(16) \qquad \tau\delta^* = \tau\delta_k + t_1 - t_2\pi_k ,$$

[6]See Hendershott (1981) and Hendershott and Hu (1981a) for a more detailed discussion of the calculation of user costs for corporate capital.

where $t_1 > 0$ reflects short tax lives and the availability of accelerated depreciation methods (with zero inflation, tax depreciation exceeds economic depreciation) and $t_2 > 0$ acknowledges the use of historic, rather than replacement, cost. Substituting (15) and (16) in (13) yields

$$(13') \qquad c_k = \alpha_1 i + \alpha_2 K/W - \alpha_3 \pi_k + \alpha_4 ,$$

where
$$\alpha_1 = b(1-\tau) + \frac{(1-b)(1-\theta)}{1-\gamma\theta-(1-\gamma)\mu_k}$$

$$\alpha_2 = \frac{(1-b)^2 R\sigma_E}{1-\gamma\theta-(1-\gamma)\mu_k}$$

$$\alpha_3 = 1 - t_2 + \frac{v(1-b)(\theta-\mu_k)}{1-\gamma\theta-(1-\gamma)\mu_k}$$

$$\alpha_4 = (1-\tau)\delta_k + (1-\tau)\tau_k^p - t_1.$$

Under current tax law, homeowners are not required to pay tax on either the real imputed rents or nominal capital gains earned from their houses nor are they allowed to deduct any depreciation in computing tax liabilities. Thus the real user cost of capital for wealthy households with no debt financing (v=0) is given by

$$(17) \qquad c_h^W = p[r_h - \pi_h + \delta_h + (1-\theta)\tau_h^p],$$

where the symbols are as defined above except that they now apply to housing. From equation (7'), r_h is the after-tax debt rate plus a risk premium equal to $R\sigma_H pH^W/W^W$.

The user cost for less wealthy households is

$$(18) \qquad c_h^N = p[vr_m + (1-v)r_h - \pi_h + \delta_h + (1-\theta)\tau_h^p] ,$$

where r_m is the after-tax (risky) mortgage rate. The relationship between this rate and the risk-free financing rate is assumed to be given by

$$r_m = (1-\theta)i + \rho_m \rho_h$$

where

$$(19) \qquad \rho_m = m_1(v-v_o) + m_2(v-v_o)^2 \qquad v > v_o$$

$$= 0 \qquad v \leq v_o$$

Below a critical level of the loan-to-value ratio v_o, the risk associated with housing investment is completely borne by the homeowners, and thus the mortgage rate they pay is equal to the risk-free rate. If the loan-to-value ratio exceeds this value, a part of the risk is shared by lenders, and consequently a risk premium has to be paid to them.[7]

Substitution of the expressions for r_h and r_m into equations (17) and (18), where r_h for the nonwealthy depends on their housing as a fraction of their wealth, yields

[7]Because the $\rho_m \rho_h$ term in the expression for r_m is the risk premium required by the lenders, the appropriate personal income tax rate is the rate that applies to the average lender. This is in contrast to equation (18) where θ is the tax rate paid by the homeowner. In our model all taxpayers pay the same tax rate so this distinction is irrelevant.

$$(17') \qquad c_h^W = p[\beta_1 i + \beta_2 \frac{pH^W}{W^W} - \pi_h + \beta_3]$$

$$(18') \qquad c_h^N = p\{\beta_1 i + \beta_2[1 - v(1-\rho_m)]\frac{pH^N}{W^N} - \pi_h + \beta_3\}$$

where $\beta_1 = 1 - \theta$

$\beta_2 = R\sigma_H$

$\beta_3 = \delta_h + (1-\theta)\tau_h^p.$

Taxes, Government Spending, and Disposable Income

Government spending is assumed to equal taxes paid by households (TX_h) and corporations (TX_k). Taxes of corporations are the sum of income and property taxes or

$$(20) \qquad TX_k = \tau[\alpha_k Y - (\delta* + bi + \tau_k^p)K] + \tau_k^p K,$$

which allows for the deductibility of (tax) depreciation, interest, and property taxes. Households pay income, property and capital gains taxes

$$(21) \quad TX_h = \theta[(Y - \delta_k K - TX_k - RE) - \tau_h^p p(H^W + H^N)] + \tau_h^p p(H^W + H^N) + \mu_k(RE + \pi_k K).$$

The first term in brackets is the sum of labor, dividend, and net interest income.[8]

[8] Net interest income is corporate interest paid under the assumption that there is no government debt. There is no need to differentiate between household interest paid and received because all households are assumed to be in the same tax bracket.

Retained earnings is the difference between corporate earnings after taxes (EAT) and dividends which under our earlier assumption equal $\nu(EAT + b\pi_k K)$:

(22) $$RE = (1-\nu)[\alpha_k Y - (\delta_k + bi)K - TX_k] - \nu b\pi_k K.$$

Finally, household disposable income is the sum of all factor payments received less taxes paid and the erosion of the real value of holdings of corporate debt:

(23) $$D = Y - \delta_k K - TX_k - RE - TX_h - \pi_k bK.$$

II. Model Summary and Parameterization

The basic model with housing and nonhousing capital perfectly interchangeable (p constant) consists of 14 equations:

(1) $Y = \gamma_k K^{\alpha_k} L^{1-\alpha_k}$

(2) $K = (1-\tau)\gamma_k \alpha_k Y/c_k$

(4') $W_r = K + H^W + H^N$

(11) $wW_r = bK + w(1-b)K + pH^W + vpH^N$

(13') $c_k = \alpha_1 i + \alpha_2 K/W - \alpha_3 \pi_k + \alpha_4$

(17') $c_h^W = p[\beta_1 i + \beta_2 \dfrac{pH^W}{wW_r} - \pi_h + \beta_3]$

(18') $c_h^N = p\{\beta_1 i + \beta_2[1 - v(1-\rho_m)]\dfrac{pH^N}{(1-w)W_r} - \pi_h + \beta_3\}$

(19) $\rho_m = m_1(v-v_c) + m_2(v-v_o)^2 \qquad v > v_o$, otherwise $\rho_m = 0$

(20) $TX_k = \tau\alpha_k Y - \{[\tau\delta_k + t_1 - (1-\tau)\tau_k^P] + \tau bi - t_2\pi_k\}K$

(21) $TX_h = \theta Y - (\theta\delta_k - \mu_k\pi_k)K - \theta TX_k - (\theta - \mu_k)RE + (1-\theta)\tau_h^P p(H^W + H^N)$

(22) $RE = (1-\gamma)\alpha_k Y - (1-\gamma)TX_k - [(1-\gamma)(\delta_k + bi) + \gamma b\pi_k]K$

(23) $D = Y - RE - TX_k - TX_h - (\delta_k + b\pi_k)K$

(3W) $H^W = \alpha_h yD(c_h^W)^{\epsilon}$

(3N) $H^N = \alpha_h(1-y)D(c_h^N)^{\epsilon}$.

The sectoral wealth variables have been replaced by wW_r and $(1-w)W_r$, respectively, where w is exogenous because p is fixed. The last two equations, where y is the portion of income accruing to the wealthy and is exogenous, are applications of equation (3). The basic model determines income (Y), the three capital quantities (K, H^W and H^N), household and business taxes (TX_h and TX_k), retained earnings (RE), disposable income (D), the risk-free rate (i), the housing loan-to-value ratio (v), and the mortgage-rate risk premium (ρ_m).

In view of our interest in explaining the allocation implications of high inflation over the past decade, a natural starting point is to set the initial values of the system roughly at their actual values in the middle 1960s. In particular, let the initial inflation rate be one percent and the initial risk-free financing rate be $3\frac{1}{2}$ percent. Moreover, expected inflation rates for corporate and housing capital are assumed to be equal.

By the assumption that nonhousing production is subject to constant returns to scale and the income elasticity of housing demand is unity, the absolute values of K, H, and L do not matter. Only their relative values are needed. Thus we arbitrarily set the initial real wealth equal to 1,000. We also set initial p equal to unity, K and H equal to 500 and Y = 525. All these can be interpreted as billions of 1965 dollars. The ratio of K to H (i.e., 500/500 = 1) is roughly the ratio of residential to nonresidential capital in the middle 1960s (see Hendershott and Hu, 1980, Table 4-8), and the ratio of Y to K approximates the ratio of GNP to nonresidential capital.

Elsewhere (1981b) we have discussed the implications of inflation for resource allocation when there are heterogeneous income groups in different tax brackets. To isolate the wealth effect from the income effect on housing demand, we assume here that all households earn the same income and pay the same tax rate. They differ from each other only by the initial wealth they possess. In most of the analysis, one-half of the households are taken to be wealthy and the other half less wealthy in the sense described below.

The various tax, depreciation and financing parameters are as follows. Tax rates: $\tau = 0.52$, $\theta = 0.3$, $u_k = 0.04$, $\tau_k^p = 0.012$, $\tau_h^p = 0.018$. Economic and tax depreciation rates: $\delta_k = 0.10$, $\delta_h = 0.025$, $t_1 = 0.01$ and $t_2 = 0.2$. Payout and financing rates: $\gamma = 0.4$, $b = 1/3$, and $v = 0.8$. With slightly over half of the housing debt-free, the average loan-to-value ratio for all housing is just under 0.4, the actual ratio for the United States. Discussions regarding the other parameters are contained in Hendershott and Hu (1980) and Hendershott (1981).

There are four risk parameters in the model: m_1 and m_2, along with v, determine ρ_m, and $R\sigma_E$ and $R\sigma_H$, along with portfolio shares, determine ρ_E and ρ_h. We set $m_1 = -0.08$ and $m_2 = 1.0$. These values result in a pattern of differences in mortgage rates with different loan-to-value ratios that approximates the observed differences in mortgage commitment rates for level-payment, fixed-rate mortgages with v's of 0.5, 0.75, 0.8, 0.9 and 0.95. For $R\sigma_E$, we use 0.12. This is consistent with a risk-aversion parameter of 3 and an after-tax expected variance of 0.04. The housing variance, σ_H, is set at 0.005. Given the above parameter values, the coefficients in the corporate user cost equation (13') are $\alpha_1 = 0.70518$, $\alpha_2 = 0.51921$, $\alpha_3 = 0.881$ and $\alpha_4 = 0.04376$. Furthermore, $c_k = 0.0908$, and the coefficients in the housing user cost equations are $\beta_1 = 0.7$, $\beta_2 = 0.015$ and $\beta_3 = 0.0376$.

The elasticity of the demand for housing with respect to the rental price or real user cost is assumed to be -0.5. Polinsky and Ellwood (1979) report an elasticity of -0.7, while Hanushek and Quigley (1980) estimate it to be -0.4. Rosen's (1979) mean price elasticity was -0.97, but the estimate was of a translog function where the elasticity declined in absolute value as the real user cost fell.[9] Moreover, his data were for 1970, when the housing real user cost had not yet been fully reduced by inflation.

Capital's share of income, α_k, is set equal to 0.2. From this and the other specified parameters, TX_k, RE, TX_h, and D can be solved recursively as $TX_k = 24.45$, $RE = 14.16$, $TX_h = 137.98$ and $D = 296.74$. The quantity of labor and γ_k are then determined by simultaneous solution of equations (1) and (2). These values are $L = 605.72$ and $\gamma_k = 0.90063$. Lastly, simultaneous solution of equations (4'), (11), (17'), (18'), (3W) and (3N) then yields the remaining parameter values: $\alpha_h = 0.41106$, $w = 0.92714$, $c_h^W = 0.05626$, $c_h^N = 0.06306$, $H^W = 257.13$ and $H^N = 242.87$.

[9] To illustrate, assume the functional form $\ell nH = \ell nD + \alpha_1 \ell nc_h + \alpha_2(\ell nc_h)^2$. The elasticity with respect to the user cost is then $\epsilon_{c_h} = \alpha_1 + 2\alpha_2 \log c_h$. Assume that the elasticity is -1 at the initial user cost, 0.0544, and set $\alpha_1 = -5.72$ (see Rosen, 1979, Table 2, p. 16). Then $\alpha_2 = -0.8106$. The elasticity at a percentage point lower user cost, 0.0444, is -0.67, and at 0.0344 the elasticity is only -0.26.

The initial balance sheets of the three sectors are listed in Table 1. Wealthy households have a well-balanced asset portfolio with between 18 and 33 percent (number in parentheses) in each of the four assets: bonds, equities, mortgages and housing. In constrast, the housing of the less wealthy is 3 1/3 times their wealth and constitutes over 90 percent of their total assets.

Table 1: The Initial Balance Sheets of the Three Sectors[a]

Wealthy Households

Bonds	166.7 (18)		
Equities	309.0 (33)		
Mortgages	194.3 (21)		
Housing	257.1 (28)	Wealth	927.1

Less Wealthy Households

Equities	24.3 (33)	Mortgages	194.3 (267)
Housing	242.9 (333)	Wealth	72.9

Corporations

		Bonds	166.7
Capital	500	Equities	333.3

[a]The numbers in parentheses are percentages of sectoral wealth.

III. The Impact of Increased Inflation: Fixed Prices

Table 2 presents some simulations of the model with the relative price of housing and the total capital stock held constant. The first column contains the initial values of the key variables. Column 2 indicates how these variables are changed by a 7 percentage point increase in the expected inflation rate from one to 8 percent. The risk-free rate rises by nearly $9\frac{1}{4}$ percentage points and the loan-to-value ratio increases slightly. Owing to the heavier taxation of returns on corporate equities than on housing, the user cost for corporate capital rises relative to that for housing; the constraint that the capital stock is fixed dictates both the magnitude of the rise in the risk-free rate and the movement of the user costs in opposite directions. As a result, the capital stock is tilted toward housing. The increase in housing (and decrease in corporate capital) is a modest 3 percent of the original stock.

Column 3 in Table 2 supplements the increase in inflation with a 75 percent increase in the risk premium on corporate equities (49 percent -- from 4 to 6 percent -- after allowing for the endogenous corporate capital response). Malkiel (1979) is the strongest proponent of the view that the risk premium has risen.[10] Because the increase may be due to the greater variability in prices associated with the higher inflation rate (Malkiel, p. 297), the joint simulation of both increases seems particularly appropriate. Addition of the increase in the risk premium roughly triples the impact of the increase in inflation on the user cost

[10] Friend and Hasbrouck (1980) also suggest a rise in the risk premium.

Table 2: The Impact of An Increase in the Inflation Rate on the Allocation of the Capital Stock When Half of Households Are Wealthy and Relative Prices are Fixed

	(1) Original Values	(2) Inflation Up by 7%	(3) (2) Plus Increase in Risk Premium	(4) (3) with Half of Less Wealthy Households Maintaining Existing Housing and Financing
Risk-Free Rate (%)	3.50	9.22	7.70	7.50
Loan-to-Value Ratio (%)	80.0	0.2	0.7	0.3
Real User Costs (%)				
Corporate Capital	9.08	0.24	0.96	0.87
Housing of Wealthy	5.63	-0.53	-1.56	-1.69
Housing of Nonwealthy	6.31	-0.52	-1.53	-1.69
Quantities (Billions)				
Corporate Capital	500.0	-15.9	-58.9	-54.1
Housing of Wealthy	257.1	9.0	33.5	38.8
Housing of Nonwealthy	242.9	6.9	25.4	15.3
Income Flows (Billions per year)				
Gross National Product	525.0	-3.4	-13.0	-11.9
Household Taxes	138.0	3.7	1.7	1.8
Business Taxes	24.4	-0.4	2.5	2.5
Retained Earnings	14.2	-12.6	-9.9	-10.1
Disposable Income	296.7	-4.5	-11.4	-10.9

of corporate capital and on the allocation of capital. Now the increase in housing (and decline in corporate capital) is 12 percent of the existing stock.

Of course, many less wealthy households did not move between the middle 1960s and late 1970s and thus did not have to refinance at the higher mortgage rate. In fact, capital gains on existing low rate mortgages are a strong incentive not to refinance.[11] The last simulation reported in Table 2 takes this fact into account. In this simulation, n proportion of the less wealthy households are assumed to have maintained their existing financing and housing. The only model changes made are the substitution of

$$(3N') \qquad H^N = (1-n)\alpha_h(1-y)D(c_h^N)^\epsilon + nH_o^N$$

for equation (3N) and the replacement of the last term in equation (11), vpH^N, with $vp(H^N - nH_o^N) + v_o p_o nH_o^N$.[12] We set $n = 0.5$.

The results of this simulation are listed in column 4 of Table 2. Because half of the less wealthy households do not alter their housing and financing, the risk-free rate and loan-to-value ratio rise less. Because all user costs are lower, the corporate capital stock and the housing of the wealthy and the less wealthy who move are all greater than in the case where all households refinance. The datum in the Table for the housing of the less wealthy in column (4) declines relative to column (3) because of the households that do not move but simply maintain their existing

[11] These gains decline in real terms over time as amortization occurs and inflation takes its toll. Thus this incentive eventually erodes.

[12] A second order wealth effect, the decline in the market value of "old" mortgages, has not been accounted for in this simulation.

housing. The impact of the nonmovers is as much on the allocation of housing among households as on the allocation between residential and nonresidential capital.

The data at the bottom of Table 2 indicate that the increase in inflation has a number of impacts on income flows. First, total income/output declines owing to the fall in corporate capital; the drop in net income is less, however, because of the fall in depreciation on corporate capital. Second, household taxes (and thus government spending) rise owing to the taxation of nominal interest and nominal increases in share prices at the personal level. Whether corporate taxes rise or fall depends on the rise in the risk-free rate. With the more plausible smaller increase in the rate [columns (3) and (4)], the increase in tax saving on interest is more than offset by the reduction in the tax saving on depreciation so taxes rise by 10 percent. Third, retained earnings fall sharply owing to the rise in interest expense and the paying out of a portion of the real gains at the expense of debtors. Fourth, disposable income tends to decline by about the sum of the fall in net income and the rise in taxes. To illustrate, consider column (3). Total income falls by $13 billion, but the decline in net income is only $7 billion because depreciation drops by $6 billion. Taxes rise by $4 billion and disposable income is reduced by $11 billion.

IV. Variable Housing Prices

In the above simulations the real price of housing was held constant. Capital was assumed to be perfectly mobile between housing and nonhousing uses, and relative real user costs allocated the capital. In fact, the real price of housing -- the ratio of the price of a constant quality house to the CPI net of shelter -- rose by 40 percent between 1965 and 1979. In the following simulations, a finite supply price elasticity is incorporated into the model, and a shift parameter is introduced into the housing supply function. Housing capital is still assumed to be perfectly tradable between wealthy and nonwealthy households.

Two major model changes are necessary. First, equation (4') is replaced by

$$(4'') \qquad W_r = \frac{K}{\lambda_1} + \frac{1}{\lambda_2}\left[\frac{(H^W + H^N)^s}{(1+s)H_o^s} + \frac{s}{1+s}\left(\frac{H_o}{H^W + H^N}\right)\right](H^W + H^N)$$

which implies that

$$(24) \qquad p = \frac{\partial W_r/\partial(H^W+H^N)}{\partial W_r/\partial K} = \frac{\lambda_1}{\lambda_2}\left(\frac{H^W+H^N}{H_o}\right)^s$$

where H_o is the initial stock of housing. The bracketed term on the right-hand side of (4"), i.e.,

$$\phi(H^W+H^N,\ H_o) = \frac{1}{1+s}\left(\frac{H^W+H^N}{H_o}\right)^s + \frac{s}{1+s}\left(\frac{H_o}{H^W+H^N}\right),$$

is the mobility factor. This factor equals 1 if there is perfect mobility of capital between residential and nonresidential uses and equals $H_o/(H^W+H^N)$

if capital is not mobile between the two uses. The former case holds when $s = 0$, and equation (4") reduces to (4) when $\lambda_1 = \lambda_2 = 1$. The latter case holds when $s = \infty$ and implies that $W_r = K + H_o$ for $\lambda_1 = \lambda_2 = 1$. As can be seen from equation (24), the coefficient s turns out to be the inverse of the supply elasticity of housing. λ_1 and λ_2 are introduced in (4") to allow for productivity change in the nonhousing and housing sectors, respectively, and they are equal to unity in the absence of technical progress. Technical progress in the nonhousing industries can be considered as an exogenous increase in γ_K in equation (1). However, because of the assumption of a Cobb-Douglas production function, it can be expressed in terms of the "capital augmenting" rate and translated into an increase in λ_1. λ_2 is likewise introduced. As can be seen from (24), the ratio λ_1/λ_2 turns out to be the exogenous shift factor in the supply function of housing. There is some empirical evidence that the efficiency increase in nonhousing industries exceeded that in the construction industry between 1965 and 1978 (Hendershott, 1980, Table 6). As a result, there has been an exogenous increase in real construction costs (Grebler, 1979, Exhibit 17). In some experiments, we will raise λ_1 to 1.15 and lower λ_2 to 0.88462, thereby abstracting from growth considerations; thus the exogenous increase in p will be from 1.0 to 1.3, or 30 percent.[13]

The second major change follows from the fact that the endogenization of p requires the endogenization of the wealth variables: W, W^W and W^N. Three equations are added:

[13] The relative changes in λ_1 and λ_2 are calibrated such that the average of the reciprocals of their levels is unity. Thus the changes leave W_r unchanged at the initial values of corporate capital and housing.

$$(5') \qquad W = K + pH$$

$$(12) \qquad W^N = W - W^W \quad \text{and}$$

$$(25) \qquad W^W = bK + \frac{W^W}{W}(1-b)K + pH^W + vpH^N ,$$

and equation (11) is replaced by:

$$(11') \qquad W^W = bK + w(1-b)K + pH_o^W + v_o p_o H_o^N .$$

Equations (11'), (5') and (12) determine the new wealth values based upon the initial housing holdings, and equation (25) imposes the sectoral balance sheet constraint based upon simulated values.

The first column of Table 3 lists the impacts of the increase in the inflation rate and equity risk premium on the key endogenous variables for the case of a fixed real housing price or an infinite supply price elasticity. The results are the same as those in column 3 of Table 2. The second and third columns here report results for supply price elasticities of 4 and 0.01 (values of s of 0.25 and 100, respectively).[14] With an elasticity of 4, the real housing price rises by 2½ percent (the increase is 6 percent for an elasticity of 2). Because this tends to raise the real user cost for housing, the increase in the risk-free rate necessary to equilibrate the market for capital goods is not as great. The increase in the real housing price provides both types of households with roughly equal dollar real capital gains because their initial housing was roughly

[14] Two recent estimates of this elasticity are 9 (Smith, 1976, p. 401) and 2 (Poterba, 1980, p. 11). We take 4 as the most likely value. Unfortunately, the range of estimates is even wider than 2 to 9.

equal. However, as a percent of initial wealth, the gain is much greater for the highly-levered, less-wealthy households, 9 percent versus 0.7 percent for the wealthy. The absolute values of the changes in user costs and quantities of capital are roughly 6 percent less than when the real price of housing is fixed (column 1).

Table 3: The Impact of an Increase in the Inflation Rate and Equity Risk Premium on the Allocation of Capital for Different Supply Price Elasticities

	(1) Infinite Elasticity	(2) Elasticity of 2	(3) Elasticity of 0.01	(4) (2) with Shift in Supply Function
Risk-Free Rate (%)	7.70	7.65	6.93	7.18
Loan-to-Value Ratio (%)	0.8	-0.8	-18.0	-12.9
Real Price of Housing (%)	0.0	2.6	45.0	31.0
Real User Costs (%):				
Corporate Capital	0.96	0.90	0.03	0.31
Housing of Wealthy	-1.56	-1.48	-0.41	-0.71
Housing of Nonwealthy	-1.53	-1.45	-0.28	-0.65
Quantities (Billions)				
Corporate Capital	-58.9	-55.4	-2.3	-20.3
Housing of Wealthy	33.5	31.1	2.8	9.7
Housing of Nonwealthy	25.4	23.6	-0.9	5.9
Income Flows (Billions per year)				
Gross National Product	-13.0	-12.2	-0.5	-4.3
Household Taxes	1.7	2.0	7.0	5.4
Business Taxes	2.5	2.4	1.1	1.5
Retained Earnings	-9.9	-10.1	-12.1	-11.4
Disposable Income	-11.4	-11.2	-7.8	-8.9

As the supply price elasticity approaches zero, more and more of the adjustment is achieved by a rise in the real price of housing and less by increases in the risk-free rate. With an elasticity of 0.01, the risk-free rate rises by only 7 percentage points and the increase in the user cost on corporate capital is only 3 basis points. The rise in the real price of housing is 45 percent, and less wealthy households maintain most of this gain in housing equity, lowering the loan-to-value ratio by 18 percentage points. Because the real user cost for housing is higher for less wealthy households, the increase in the real supply price of housing raises their user cost relative to that of wealthy households, although both decline, tending to raise the demand for housing. The small fall in the quantity of housing demanded by the less wealthy is attributable to the decline in disposable income. This, in turn, is due to an increase in taxes, $2.8 billion of which is property taxes on the inflated house values.

Column (4) is the result of a simulation with both a supply price elasticity of 4 and an exogenous 30 percent upward shift in the supply of housing schedule ($\lambda_1 = 1.15$, $\lambda_2 = 0.88462$).[15] The results are quite similar to those of column 3 where the supply price elasticity was near zero. Because the real price of housing rises by less, the risk-free rate rises by more and the reallocation away from corporate capital is $20 billion or 4 percent.

[15] One-third or 10 percent of this shift is probably better interpreted as a result of the supply elasticity of 4. Between 1965 and 1978 the stock of residential housing increased by about 45 percent. This is not incorporated into our analysis which abstracts from growth considerations. From equation (24) and the assumption that $s = 1/4$, this increase would raise p from 1.0 to $1.1 = (1.45)^{0.25}$.

V. The Capital Market Constraint

Recent empirical studies suggest that nominal, as well as real, mortgage rates affect housing demand.[16] The most straight-forward cause of this result is the well-known housing cost/income limit that lenders impose on borrowers. Housing costs, excluding utilities, are the sum of outlays for maintenance, property taxes, and mortgage payments. In terms of our earlier symbols, the ratio of nonutility housing costs (HC) of the nonwealthy households that move to their after-tax labor income (Y*) is:

$$(26) \qquad \frac{HC}{Y^*} = \Big[\delta_h + (1-\theta)\tau_h^p + \frac{r_m(1+r_m)^{25}}{(1+r_m)^{25}-1}\Big] \frac{p(H^N - nH_o^N)}{Y^*}\Big],$$

where $Y^* = (1-y)(1-n)(1-\theta)(1-\alpha_k)Y$ and r_m is the after-tax mortgage rate on a level-payment mortgage with a 25 year life. Using the initial values of the variables, the ratio is 0.135. For the purposes of the paper, we specify the limit allowed by lenders to be 0.17.

When equation (26), after setting the left-side equal to 0.17, is solved for v using the values of i, ρ_m, H^N and Y from the simulation of increases in inflation and the risk premium, a value of 48 percent is obtained. That is, mortgage payments and other costs rise so high relative to income that lenders (wealthy households) would be willing to extend only 72 percent (48/67) of the mortgage debt desired by less wealthy

[16] Hendershott (1980) and Follain (1981) report macro and micro evidence, respectively. See also Kearl and Mishkin (1977).

households who move. The credit shortfall is $62 billion (0.67-0.48 times $326 billion). In the absence of more innovative financing instruments, such as graduated payment or shared appreciated mortgages, these households are simply unable to purchase the desired housing.

To incorporate this constraint into the analysis, we replace the equation for the desired housing demand of less wealthy households with equation (26) after setting the left-hand side equal to 0.17. In effect, this equation determines the loan-to-value ratio and the quantity of housing held is derived from the balance sheet constraint of these households. The results from a simulation of the revised model are listed in column 2 of Table 4; column 1 repeats column 4 of Table 3 where the capital market constraint is not binding. The loan-to-value ratio declines by nearly 5 percentage points relative to column 1, and the increase in the risk-free interest rate is three-quarters of a percentage point less. Because "rationing" of less wealthy households occurs, a smaller increase in interest rates and in the user cost for corporate capital is needed to equilibrate the capital market. While the user cost for nonwealthy households falls sharply, it is irrelevant; the capital-market constraint leads to a decline in their housing. The net result is an unchanged stock of corporate capital, and a significant reallocation of housing from the less wealthy to the wealthy. The housing of the latter now falls by 6 percent instead of rising slightly.

Of course, many less wealthy households will not move when faced with high nominal mortgage rates and a binding capital market constraint. The data in column 4 are the simulation result when one-half of these

Table 4: The Impact of an Increase in the Inflation Rate and Equity Risk Premium on the Allocation of Capital when Capital Market Constraints Exist on Less Wealthy Households

	(1) Column 4 from Table 3	(2) (1) with a Capital Market Constraint	(3) (2) when Half of Less Wealthy Households Maintain Existing Housing
Risk-Free Rate (%)	7.18	6.44	6.63
Loan-to-Value Ratio (%)	-12.9	-17.6	-13.2
Real Price of Housing (%)	31.0	30.0	30.3
Real User Costs (%):			
Corporate Capital	0.31	0.00	0.08
Housing of Wealthy	-0.71	-1.37	-1.20
Housing of Nonwealthy	-0.65	-1.39	-1.31
Quantities (Billions)			
Corporate Capital	-20.3	0.1	-5.4
Housing of Wealthy	9.7	31.3	25.2
Housing of Nonwealthy	5.9	-31.4	-21.1
Income Flows (Billions per year)			
Gross National Product	-4.3	0.0	-1.1
Household Taxes	5.4	6.0	5.8
Business Taxes	1.5	1.4	1.4
Retained Earnings	-11.4	-12.0	-11.8
Disposal Income	-8.9	-7.1	-7.6

households are assumed to maintain their existing housing. Because the housing of nonmoving, less wealthy households does not decline (the credit market constraint is less binding in the aggregate), the increase in the risk-free rate is greater than in column 2 and the decline is the loan-to-value ratio is less. The net result is a small, one percent, decline in corporate capital and offsetting rise in housing capital. There is still a significant shift in the housing stock from the less wealthy to the wealthy; in fact, the housing of the less-wealthy movers now falls by a full $17\frac{1}{2}$ percent [21.1/(242.9x0.5)].

The imposition of the credit market constraint in the simulations is an admittedly crude attempt to approximate the real world. Our method of imposing the constraint tends to overstate its impact on housing demand for three reasons. First, all the impact of the constraint falls on housing; in fact, constrained households would also be expected to hold less of other assets, equities in our model. (Because equity holdings of the constrained households are only 10 percent of their housing, this source of overstatement is not large.) Second, if the income elasticity of housing is less than unity and if households that move do so to earn higher real income, then the credit market constraint is less binding than our treatment implies. Third, the limit on the housing costs/income ratio assumed to be imposed by lenders, 0.17, is probably too low. On the other hand, our method tends to understate the impact in an important respect. The calculations assumed that all households owned houses in 1965 and reaped 30 percent real capital gains since then. As a result the desired loan-to-value ratio declined from 80 percent to 67 percent. In reality, many less wealthy households are of a more recent vintage and have not participated in these real capital gains. For these households the desired loan-to-value ratio is close to 80 percent and thus the credit market constraint is far more binding than that based on our analysis. 17/ On balance, we view our results as roughly indicative of the aggregative impact of the capital market constraint.

The simulation results reported in column 3 are also consistent with the changes observed between the middle 1960s and late 1970s in many respects other than the maintenance of the corporate capital stock. Three seem worthy of note. First, the ratio of the increase in the risk-free rate to the increase in the inflation rate, 0.95, is roughly that observed. Second, the 6 percent increase in real business taxes is close to the observed 10 percent increase in real profit taxes between 1965 and 1979. Third, the sharp fall in real retained earnings (after adjustment for inventory valuation and capital consumption allowances), 83 percent, is not far from the observed 70 percent decline between the same years.

VI. Conclusion

We have constructed a simple two-sector model of the demand for housing and corporate capital. An increase in the inflation rate, with and without an increase in the risk premium on equities, was then simulated with a number of model variants. The model and simulation experiments illustrate both the tax bias in favor of housing (its initial

[17] This suggests that the distributional impact of inflation on households is far more complex than that implied by our two household world. Extension of the model to allow for a greater diversity of households would be useful.

average real user cost was 3 percentage points less than that for corporate capital) and the manner in which inflation magnifies it (the difference rises to 5 percentage points without an exogenous increase in real house prices and 4 percentage points with an exogenous increase). The existence of a capital-market constraint offsets the increase in the bias against corporate capital, but it introduces a sharp, inefficient reallocation of housing from less wealthy, constrained households to wealthy households who do not have gains on mortgages and are not financially constrained. Widespread usage of innovative housing finance instruments would overcome this reallocation but at the expense of corporate capital. Only a reduction in inflation or in the taxation of income from business capital will solve the problem of inefficient allocation of capital. Current legislative proposals to increase business depreciation allowances and to reduce the corporate tax rate and the taxation of capital gains are steps in the latter direction.

The simulation results are also able to provide an explanation for the failure of nominal interest rates to rise by a multiple of an increase in the inflation rate in a world with taxes.[18] When the inflation rate alone was increased, the ratio of the increases in the risk-free and inflation rates was 1.32. This is a weighted average of the increases necessary to leave the real user costs of corporate (1.30) and housing (1.43) capital constant, where the former is weighted twice as heavily as the latter because the elasticity of corporate capital with respect to the real user is twice as large as the elasticity of housing. The necessary increases depend on the taxation of corporate and housing income at both the personal

[18] See Feldstein and Summers (1978) and Hendershott (1981) for earlier efforts at solving this puzzle.

and, for the former, corporate levels. To illustrate, the necessary ratio for housing is simply $1/(1-\theta)$. An increase in the risk premium on equities, in conjunction with the increase in inflation, lowered the simulated ratio to 1.10, introduction of a supply price elasticity of 4 and an exogenous increase in the real house price reduced the ratio to 1.03, and incorporation of the credit-market constraint reduced the ratio to 0.95.

The present model can usefully be extended in a variety of directions, one of which seems especially important. Currently, aggregate savings is implicitly assumed to be equal to replacement investment of real and housing capital. Thus the real stock of wealth of the economy remains constant over time. In the real world, however, aggregate savings tends to exceed the replacement investment of capital and the positive net investment ensures that the real stock of wealth grows over time. Capital accumulation and income growth would have no effect on its relative allocation between the two uses if the income elasticity of housing demand were unitary and the real user costs were constant. In fact, there appears to be a general concensus that the income elasticity of housing is significantly less than unity (Hanushek and Quigley, 1980, Polinsky and Ellwood, 1979, and Rosen, 1979) and the real user costs have not been constant. To accomodate these factors and to deduce the impact of inflation on capital accumulation generally, the model will be extended in a growth setting. This will allow for changes in real after-tax interest rates and real wealth (including the effect of increases in the real price of housing) to impact on saving.

References

Ballentine, J. Gregory (1981), "The Impact of the Interaction between Taxes and Inflation in an Economy with Business and Housing Sectors," Mimeo, University of Florida.

Diamond, Douglas B., Jr. (1980), "Taxes, Inflation, Speculation, and the Cost of Homeownership: 1963-78," AREUEA Journal, Fall.

Ebrill, Liam P. and Uri M. Possen (1980), "Inflation, Aggregate Demand, Capital Accummulation and Productivity," NBER Conference Paper No. 53.

Feldstein, Martin S., (1981), "The Distribution of the U.S. Capital between Residential and Industrial Uses," Economic Inquiry, Vol. XIX, No. 1.

Feldstein, Martin S. and Lawrence Summers (1978), "Inflation, Tax Rules, and the Long-Term Interest Rate," Brookings Papers on Economic Activity, 1.

Follain, James R., Jr. (1981), "Does Inflation Affect Real Behavior: The Case of Housing," Southern Economic Journal, forthcoming.

Friend, Irwin and Marshall Blume (1975), "The Demand for Risky Assets," American Economic Review, Vol. 65, No. 5, 900-22.

Friend, Irwin and J. Hasbrouch (1980), "Effects of Inflation on Profitability and Valuation of U.S. Corporations, "Mimeo, University of Pennsylvania.

Grebler, Leo (1979), "The Growth of Residential Capital Since World War II," AREUEA Journal, Winter.

Hanushek, Eric A. and John M. Quigley (1980), "What is the Price Elasticity of Housing Demand?" Review of Economics and Statistics, Vol. 62, August.

Hendershott, Patric H., (1980), "Real User Costs and the Demand for Single Family Housing," Brookings Papers on Economic Activity, 2.

________________ (1981), "The Decline in Aggregate Share Values: Taxation, Valuation Errors, Risk and Profitability," American Economic Review, December.

Hendershott, Patric H. and Sheng Cheng Hu (1980), "Government-Induced Biases in the Allocation of the Stock of Fixed Capital in the United States," in G.M. von Furstenberg (ed.) Capital, Efficiency and Growth, Ballinger Publishing Company.

________________ (1981a), "Investment in Producer's Equipment," in H.J. Aaron and J.A. Pechman (eds.) How Taxes Affect Economic Behavior, Brookings Institution.

________________ (1981b), "Inflation and Extraordinary Returns on Owner-Occupied Housing: Some Implications for Capital Allocation and Productivity Growth," Journal of Macroeconomics, Vol. 3, Spring.

Kau, James and Donald Kennan (1981), "Inflation, Taxes and Housing in a Growing Economy," Mimeo, University of Georgia.

Kearl, James R. and Frederic S. Mishkin (1977), "Illiquidity, the Demand for Residential Housing, and Monetary Policy," The Journal of Finance, December.

Malkiel, Burton G. (1979), "The Capital Formation Problem in the United States," Journal of Finance, Vol. 34, May, 291-306.

Polinsky, A. Mitchell and David T. Ellwood (1979), "An Empirical Reconciliation of Micro and Grouped Estimates of the Demand for Housing," Review of Economics and Statistics, Vol. 61, May .

Poterba, James (1980), "Inflation, Income Taxes and Owner-Occupied Housing," NBER Working Paper No. 553, September.

Rosen, Harvey S. (1979), "Housing Decisions and the U.S. Income Tax: An Econometric Analysis," Journal of Public Economics, Vol. 11.

Slemrod, Joel (1980), "A General Equilibrium Model of Capital Income Taxation," Ph.D. dissertation, Harvard University, 1980.

__________________ (1981), "A General Equilibrium Model of Taxation with Endogenous Financial Behavior," presented at a conference on Simulation Methods in Tax Policy Analysis, Palm Beach, Florida January 26-27.

Smith, Barton A. (1976), "The Supply of Urban Housing," Quarterly Journal of Economics, August.

Villani, Kevin E. (1981), "The Tax Subsidy to Housing in an Inflationary Environment: Implications for After-Tax Housing Costs," in C.F. Sirmans (ed.) Research in Real Estate, JAI Press.