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# THE DYNAMIC EFFICIENCY COST OF NOT TAXING HOUSING

**ABSTRACT**

Housing assets comprise nearly one-third of household wealth but effectively escape income taxation. When housing is included in the life cycle model, the capital income tax is shown to be far more distortionary than previously thought. The reason is that capital income taxation stimulates the price of (untaxed) housing capital and thereby crowds out nonhousing wealth in the long-run. Even when aggregate saving is unaffected by the after-tax rate of return, the crowding out of nonhousing wealth erodes the tax base and generates very high measures of marginal excess burden.

Movements in U.S. aggregate wealth are consistent with the predictions of the model. Overall household wealth as a ratio of national income in 1989 is nearly identical to the ratio in 1955, but the ratio of housing assets to nonhousing wealth has grown by 30 percent since 1970. In short, capital income taxation may attenuate capital accumulation through its impact on housing prices rather than through traditional incentive effects.

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## I. Introduction

The taxation of capital income is often viewed to be a highly inefficient method of collecting revenue. On the basis of both two-period models and more elaborate simulation models, studies have demonstrated that capital income taxation can substantially reduce both long-run saving and steady-state welfare.[1] A necessary condition for these results to hold, however, is that the saving rate respond positively to the net interest rate -- an empirical proposition that gains little support from the data.[2]

This paper demonstrates that when the life cycle model is expanded to include housing as both a consumption item and an investment that enjoys preferential tax treatment, the capital income tax is even more inefficient than previously thought. Illustrative calculations using a dynamic overlapping generations two-period model with a housing sector imply that an increase in the tax on nonhousing capital leads to "Laffer" effects in which long-run revenue declines. Furthermore, these results do not rely on implausible long-run saving elasticity --

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[1] For only a partial list, see Boskin (1978), Feldstein (1978), Summers (1981a), Fullerton, Shoven, and Whalley (1983), Auerbach, Kotlikoff, and Skinner (1983), Auerbach and Kotlikoff (1987), and Judd (1987).

[2] For example, see Hall (1988), Howrey and Hymans (1978), and Skinner and Feenberg (1990). For an opposing view see Boskin (1978) and Summers (1984). Feldstein (1978) has shown that a zero *private* saving elasticity can be consistent with large efficiency costs of capital income taxation, but his result does not hold for a zero *national* saving elasticity (see footnote 9).

in fact, the implied interest elasticity of saving may be zero or even negative.

Increasing the tax on capital income reduces the net return on taxable assets, which in turn makes fixed capital assets, such as housing, more valuable. While the windfall gain from housing appreciation benefits current (older) generations, future (younger) generations must pay more for the identical house. It is possible that these younger generations must increase long-run saving as they devote a larger fraction of earnings and wealth to purchasing the expensive housing. Furthermore, future generations are worse off because they both pay more for housing services and suffer a potential reduction in revenue as untaxed housing wealth crowds out taxable nonhousing capital. That is, tax policy may have the greatest impact on the composition of wealth rather than on the overall level of wealth.

The taxation of nominal rather than real capital income during the inflationary 1970s -- and the consequent increased tax burden on capital -- has been viewed by many economists as the major cause of housing price appreciation during the same period.[3] One empirical implication of this model is that the housing wealth appreciation should crowd out nonhousing capital,

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3 See Feldstein (1980), Summers (1981b), Poterba (1984), Summers (1987), Goulder and Summers (1989), and Goulder (1989). For a dissenting view, see Fullerton (1983), who suggests that because debt interest could be deducted at a higher rate than the tax rate on equity, inflation-generated high interest rates could actually reduce marginal effective tax rates.

with only mininal effects on overall wealth accumulation. Recent trends in the United States are consistent with this view. Since 1970, the ratio of housing (and land) wealth to nonhousing wealth has grown from 33 to 44 percent, an increase of one-third. Nearly all of this shift was caused by price appreciation, and not by new construction. Yet the overall level of U.S. household wealth (excluding durables) as a fraction of national income in 1989 is effectively unchanged from its value in 1970.

There are three potential shortcomings of the model. First, an alternative explanation for the housing wealth appreciation is that housing demand by the baby boom drove up housing prices (Mankiw and Weil, 1989). This paper shows that even if demographic changes had accounted for the entire shift in housing wealth, the tax subsidy to housing still causes intergenerational transfers from future to current generations and a dramatic erosion of revenue. Second, the derived results may be an artifact of the simplified two-period model with fixed housing supply. A more elaborate intertemporal simulation model with 55 periods, endogenous housing price, and a positive supply elasticity of housing yields results similar to the two-period model (Skinner, 1989). The third shortcoming is that a Ricardo-Barro bequest motive effectively undoes the intergenerational wealth effects of subsidized housing; current generations save their housing windfalls to benefit future generations facing more expensive housing. A bequest motive would alter the results derived below, but the empirical support for this view is not strong. Increases in U.S. housing wealth appear to be offset almost dollar-for-dollar by decreases in nonhousing wealth.

## II. A Model of Housing, Consumption, and Saving

A number of dynamic models have analyzed the role of a fixed asset, typically land, in international trade (Eaton, 1987,1988), fiscal policy and taxation (Feldstein, 1977; Chamley and Wright, 1987), and in development (Drazen and Eckstein, 1988). While the model discussed below will follow the basic structure of these two-period models, there is one major difference; the long-lived asset in this model serves as both a consumption durable and a productive input.[4] This consumption aspect of housing leads to results somewhat different from previous models.

Feldstein (1977) was the first to show the incidence of a tax on a long lived asset (land) in a general equilibrium model. By taxing land, the current generation suffers a capital loss, and future generations gain from cheaper land prices and increased capital accumulation. More recently, Chamley and Wright (1987) have generalized the Feldstein model and characterized the dynamic paths of asset prices and saving by

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[4] For examples of models with housing consumption constrained equal to housing investment, see Berkovec and Fullerton (1989,1990) and Henderson and Ioannides (1983).

taking a linear approximation around the steady state. They find that a tax on land stimulates capital accumulation in economies which satisfy a "crowding out" condition. That is, if retiring government debt stimulates national saving, then a land tax will stimulate saving.

As Chamley and Wright (1987) have emphasized, there is a strong parallel in life cycle models between government debt and land taxation (or subsidies). In the case of tax-subsidized housing, the current owner enjoys the full capitalized value of the unexpected subsidy, but future generations must pay for the subsidy through higher housing prices.[5] A tax on nonresidential saving which causes housing prices to rise therefore implicitly gives a "bond" to current homeowners with a corresponding "interest payment," the loss in revenue from the housing subsidization, paid by future homeowners. As in the case of government bonds, the wealth effect of land taxation disappears in a model with Ricardian bequest motives (Calvo, Kotlikoff, and Rodriguez, 1978).

Goulder (1989) has examined the impact of taxation on housing asset prices in a general equilibrium simulation model. He finds that tax changes cause housing prices to shift, but the impact on saving and capital accumulation is smaller in magnitude than the model presented below. The reason is that

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[5] Equivalently, the subsidy compensates the homeowner for the higher housing price, but future generations must pay higher taxes to finance the subsidy.

homeowners in Goulder's model live forever, so there are no life cycle wealth effects.[6] The model discussed in this section is closest in structure to Chamley and Wright (1987); the differences are that housing consumption and investment are constrained to be equal, the model is partial rather than general equilibrium, and consumption plans and housing prices are derived exactly using an explicit utility function rather than approximated around a steady-state path.

Assume that utility can be expressed as

$$U = \ln C_1 + (1+\delta)^{-1}\ln C_2 + \alpha(1+\delta)^{-1}\ln h \qquad (1)$$

where $C_i$ is consumption in period i, h is housing consumed (only) in the second period, $\delta$ is the time preference rate, and $\alpha$ is a parameter indicating tastes for housing.

Assume that per capita earnings in year t, $Y_t$, are exogenous. Individuals forego current consumption to purchase second period consumption and housing. The gross interest rate $r^*$ is fixed and the only source of tax revenue is from the interest income tax $\tau$. It is useful to write the second period budget constraint;

[6] Gahvari (1984) also distinguishes between housing and nonhousing capital in a dynamic model. He finds that differential taxation of the two sectors may be efficient if doing so assists the economy in attaining the optimal (golden rule) accumulation path.

$$C_2 + \rho h = [Y-C_1-V_1h][1+r] + [\rho-\epsilon]h + (V_2+\tilde{V}_2)h + R \qquad (2)$$

where $\rho$ is the implicit rental price of the fixed stock of housing, $\epsilon$ is the implicit (specific) tax or subsidy on housing, $r \equiv r^*(1-\tau)$ is the net rate of return, and R is the lump sum tax rebate awarded in the second period. Note that $\rho h$ is included both as an expenditure on the house, and as a return on an investment. The house is purchased at the end of period 1 for $V_1h$ and sold at the end of period two for $(V_2+\tilde{V}_2)h$. The selling price is broken into two parts; the first is the expected selling price $V_2$ while the second part $\tilde{V}_2$, is the unexpected capital gain or loss occurring because of a shift in the tax law. In general, $\tilde{V}_2$ is zero except during transition generations.

The timing of the model is that individuals work while young, and consume only the composite consumption good $C_1$. At the end of the first period, they divide the proceeds of their saving, $Y - C_1$, into the house, and into traditional nonhousing capital $Y - C_1 - V_1h$.[7]

I invoke the arbitrage assumption that the net rate of return on housing plus (expected) capital gains is equal to the net return on nonhousing investment;

$$(\rho-\epsilon) + (V_2-V_1) = r^*(1-\tau)V_1. \qquad (3)$$

[7] It is irrelevant how the homeowner finances his or her house; if it were debt financed, taxable income would still be $Y - C_1 - V_1h_2$.

Substituting (3) into (2) and expressing in terms of first period consumption yields

$$C_1 + [C_2 + \rho h](1+r)^{-1} = Y + R(1+r)^{-1} \tag{4}$$

Rather than using $\epsilon$ in the derivations that follow, it is easier instead to define $\theta \equiv \epsilon(r^{*}V_1)^{-1}$ to be the tax or subsidy on housing services expressed as a ratio to the gross return on nonresidential saving; when $\theta = \tau$ the two assets are equally taxed. Revenue is

$$R = (Y-C_1)r^{*}\tau + (\theta-\tau)r^{*}V_1h \tag{5}$$

Holding $C_1$ constant, it is clear that growth in $V_1$, for whatever reason, will reduce government revenues to the extent that $\theta - \tau$ is negative. That is, holding aggregate saving constant, an increase in house prices will cause a shift from taxable investments to tax sheltered investments, leading to a decline in government revenue.

From the first order conditions,

$$C_1 = \frac{Y + R(1+r)^{-1}}{D} \tag{6}$$

where $D = [1 + (1+\alpha)(1+\delta)^{-1}]$. Substituting (6) into (5) and solving for government revenue yields

$$R = \frac{Y[D-1]r^{*}\tau + V_1(\theta-\tau)r^{*}Dh}{D + (1+r)^{-1}r^{*}\tau} \tag{7}$$

while substituting (7) into (6) provides an expression for $C_1$;

$$C_1 = \frac{Y(1+r^*) + V_1(\theta-\tau)r^*h}{D(1+r) + r^*\tau} \tag{8}$$

The aggregate capital stock per old person is $K = Y - C_1$, and steady-state saving (also per old person) is $n(Y-C_1)$ where n is the growth rate in population. The total capital stock K is divided between housing capital $K_h = hV_1$ and nonhousing capital $K_{nh} = Y-C_1-hV_1$.

The supply of housing h is assumed to be fixed. This assumption is maintained for two reasons. First, it allows an analytic solution for the two-period model. Second, by assuming a fixed supply of housing, I rule out the traditional static distortion caused by the overconsumption of housing services (see Rosen, 1985). Hence any impact of housing on the excess burden of the capital income tax occurs only through dynamic effects.

At this stage, it is useful to introduce time subscripts to solve for $V_t$, the time t price of housing. In this model, the price of housing may be constant in the steady state, or it may rise or fall at a constant rate if the supply of housing grows at a rate different from the growth in population. Let the exogenous growth in housing be $\ell$, so that the per capita housing stock (per old person) is $h_t = h_0[(1+n)/(1+\ell)]^t$. The shadow price of housing services, $\rho$, is that price which makes the demand for housing equal to the fixed supply;

$$\rho_t = \alpha\left[\frac{1+r}{1+\delta}\right]\frac{Y_t+R_{t+1}(1+r)^{-1}}{Dh_t} \tag{9}$$

Substituting (9) into the arbitrage condition (2), and rearranging, yields

$$V_{t+1} = V_t\left[1+r^*\left[(1+\theta-\tau)-\frac{\alpha}{1+\delta}(\theta-\tau)\Delta^{-1}\right]\right] - \frac{\alpha Y_t(1+r)}{(1+\Delta)h_t}\left[\frac{1+n}{1+\ell}\right] \tag{10}$$

where $\Delta = D + (1+r)^{-1}r^*\tau$. When the coefficient on $V_t$ in equation (10) exceeds $(1+\ell)/(1+n)$, the stable solution to the linear difference equation is

$$V_t = \left[\frac{\alpha Y_t(1+r^*)}{(1+\delta)h_t\Delta}\right]\sum_{j=1}^{\infty}\left[1+r^*[(1+\theta-\tau)-\frac{\alpha}{1+\delta}(\theta-\tau)\Delta^{-1}]\right]^{-j}\left[\frac{1+n}{1+\ell}\right]^j \tag{11}$$

The general solution for $V_t$ is presented in the appendix; a simpler solution which assumes that $\ell = n$ (ensuring constant steady-state prices) is given by

$$V = \frac{\alpha Y(1+r)}{h_0 r^*[\Delta(1+\theta-\tau)(1+\delta)-\alpha(\theta-\tau)]} \tag{12}$$

The impact of a tax on capital can be separated into its long-run and short-run effects. The tax change is unexpected in the short run, so the government collects a lump-sum assessment on existing capital. Since $dV/d\tau > 0$ (as is shown in the Appendix), the older generation enjoys the capital gain $\tilde{V}_2h$ from the sale of their house to the next generation. The short-run saving rate will fall as the older generations "spend down" their windfall housing capital gains.

Because $r^*$ is fixed and there are only two generations alive at any given time, the economy arrives at its new steady state in two periods. The long-run effect of the tax change on capital accumulation is summarized by $dK/d\tau = -dC_1/d\tau$, where earnings are held constant. From equation (8), one can write

$$\frac{dC_1}{d\tau} = \frac{r^*(1+r^*)}{\Omega\ (1+r)} \left[ (Y-C_1-V_1h) + (\theta-\tau)h\frac{dV}{d\tau} \right] \qquad (13)$$

and $\Omega = D(1+r) + r^*\tau$, while $dV/d\tau$ is described in the appendix. The first term in the bracket of equation (13) captures the traditional effect on consumption of a compensated tax change.[8] The second term shows that when housing is tax-preferred (so that $\theta < \tau$), $\partial C_1/\partial V < 0$; individuals must forego consumption while young (and consumption while old) to afford the more expensive housing. Hence one cannot sign $dC_1/d\tau$; saving may either rise or fall in response to the increase in the capital

[8] That is, in a log linear utility function, the uncompensated effect on $C_1$ of an increase in r is zero; but the first-order compensation $dR/d\tau = r^*(Y-C_1-V_1h)$ raises $C_1$ through the income effect.

income tax.[9]

Similarly, the long-run change in revenue as a consequence of the tax increase can be positive or negative;

$$\frac{dR}{d\tau} = \frac{r^*[Y - C_1 - Vh + (\theta-\tau)h\frac{dV}{d\tau}]}{1 + (1+r)^{-1}D} \tag{14}$$

The question is therefore whether the stock of taxable assets $Y-C_1-Vh$, exceeds the tax loss caused by the revaluation of the housing assets. To provide an illustrative answer to this question, the next section calculates the magnitudes of $dR/d\tau$ and $dK/d\tau$ given a set of reasonable parameters.

## III. Calculations of Excess Burden in a Two Period Model

To calculate the excess burden and interest elasticity of the compensated tax, assume that one "period" in the two-period

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[9] Feldstein (1978) argued that the interest elasticity of saving is indeterminate for a different reason. He showed that a compensated shift in taxation will affect private saving $S^p$ in the following way:

$$dS^p/d\tau = n(dR^*/d\tau - dC_1/d\tau)$$

where $R^*$ is the lump-sum tax rebate awarded in the first period and housing assets are ignored. The rebate $dR^*/d\tau$ could easily offset $dC_1/d\tau$ (which is always nonnegative), so that $dS^p/d\tau \gtrless 0$. However, the compensation $R^*$ is provided in the first period but taxes are collected in the second period. Hence the government must borrow $dR^*/d\tau$, so that overall national saving, including both government and private saving, is $-dC_1/d\tau \leq 0$. (see Samdmo, 1981).

model lasts for 20 years, the real annual rate of return is 8 percent, and the annual marginal tax rate is 37 percent (King and Fullerton, 1984).[10] Assume further that the time preference rate is 0.5 percent, the spot price of housing is normalized to 1.0, and aggregate earnings are $30,000 per year. The resulting derivatives of the model are shown in Table 1 with all values expressed in units of one thousand dollars. In the first column, the housing preference parameter $\alpha$ is set to .0001 to characterize a standard model that ignores housing. The model predicts that increasing the tax by 10 percentage points will reduce saving by 15.8 percent (since saving is proportional to K and $dK/Kd\tau = -16.1/10.2$). In the short run, the tax is lump-sum, and a ten-percentage point increase in the effective tax rate will increase revenue by $3,750 (that is, 10 percent of $37.5 thousand). In the long-run, revenue will rise by $1,920. The marginal efficiency cost of the tax -- the loss in utility which occurs when the government raises $1 in additional revenue and returns it in a lump sum fashion -- is written from equation (1) as

$$\frac{dU}{\lambda d\tau} = \frac{dC_1}{d\tau} + (1+\delta)^{-1}\left[\frac{C_1}{C_2}\right]\frac{dC_2}{d\tau} \qquad (14)$$

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[10] In the two period model, $\tau = \left[\frac{(1+.08(1-.37))}{1.08}\right]^{-20} - 1$. Since 1986, of course, marginal tax rates at the household level have been lowered.

where $\lambda = C_1^{-1}$, the marginal utility of income. (Since h is constant, it can be ignored.) Column (1) of Table 1 shows that the short-run marginal efficiency cost of the 10 percent tax increase is zero; the tax is collected and return in a lump sum fashion. But in the long run steady state, the efficiency cost is -\$690, or a loss of 36 cents per dollar of revenue collected.

When $\alpha = .29$ (the share of housing expenditures in total consumption; Statistical Abstract, 1987, p. 430), the ratio of housing to total capital is .494. While the capital income tax reduces total saving, the magnitude of the effect is roughly one-fourth the magnitude in the traditional model; a 10 percentage point tax increase reduces saving by only 1.8 percent. The model also suggests that in the long run steady state, the economy is on the wrong side of the Laffer curve; a tax rate increase implies a revenue loss. In present value terms, however, the government still raises revenue from the capital income tax owing to the first-period lump sum assessment on existing capital.

The long-run marginal welfare cost of increasing the tax by 10 percentage points is more than double the efficiency cost in the traditional model (-\$1530 versus -\$690). In terms of the excess burden per dollar of revenue raised, the marginal efficiency cost is infinite since raising the tax raises no revenue -- it loses revenue while making the individual worse off.[11]

These long-run comparisons overstate the differences in utility loss since they ignore the current generation of homeowners who gain $300 from the capital income tax. Both the present value of utility expressed in dollar terms and the present value of revenue can be calculated from the example above. The marginal excess burden is 8.4 cents per dollar in the model without housing, but 26.2 cents per dollar in the model with housing.[12] Note that these measures are lower than the conventional measures of excess burden because a large fraction of the revenue is from an essentially lump-sum assessment of capital in the transition stage.

The third column in Table 1 shows the effect on the capital stock and on revenue of a tax change when the imputed return to housing is subject to the same tax ($\theta = \tau$). In this case, additional taxation of nonresidential and residential capital has a much smaller impact on house values, $dV/Vd\tau$ is only 0.1 rather than 1.1, so that housing prices are relatively insensitive to tax fluctuations. In present value terms the marginal efficiency cost of the tax is only 9.7 cents per dollar

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[11] Marginal excess burden tends towards infinity as the denominator $\partial R/\partial \tau$ converges to zero at the peak of the Laffer curve.

[12] Discounting at the rate r, the present value of the utility change caused by a 10 percentage point increase in $\tau$ without housing is -$413 = -$690/r; with housing, the present value is -$616 = $300 - $1530/r. The present value of the revenue change (also discounted at the rate r; see Judd, 1987 p. 688) is $4900 = $3750 + $1920/r in the model without housing and $2346 = $2550 - $340/r in the model with housing.

of revenue raised, less than half the marginal efficiency cost when housing is not taxed. That is, excluding housing from the tax base more than doubles the marginal efficiency cost of a tax on capital income.[13]

## IV. Taxation and Housing: Different Views

There are three reasons why the model presented above may provide a restricted picture of housing and taxation. First, demographic shifts may have been a major factor in the housing price increases. Second, the two period life cycle model with a fixed supply of housing (consumed only in the last period) and no bequests may provide an oversimplified view of the housing market. Finally, a bequest motive may affect the conclusions of the model. This section addresses each of the limitations in turn.

### (A) "Housing Prices Rose Because of the Baby Boom"

The taxation explanation for housing price increases was successful in predicting the increased housing prices in the 1970s but less successful in predicting the stagnation in housing prices during the 1980s (Hendershott, 1987a). Both the reduction in marginal tax rates, and the fall in inflation, should have predicted a sharp decline in housing prices. Mankiw

[13] Recall that housing is in fixed supply. Differences in marginal efficiency cost are therefore due entirely to dynamic rather than static distortions.

and Weil (1989) suggest that housing prices rose during the 1970s because the baby boom had reached the age at which housing became a larger fraction of their consumption budget. Demand increased, and given a relatively inelastic supply of housing, prices jumped. They also predict a sharp decline in housing prices when the baby boom buying bug abates. While Mankiw and Weil (1989) are primarily concerned with temporary shifts in housing demand, the exogenous shift in housing demand caused by population growth can be modeled in the simple two period framework by a change in n (population growth) holding $\ell$ (housing growth) constant.[14] The immediate effect on V once n changes (evaluated at $n = \ell$) is

$$dV_t/dn = V_t(1+n)^{-1}\left[1 + \left[(1+\theta-\tau) + \frac{\alpha(\tau-\theta)}{\Delta(1+\delta)}\right]^{-1}\right] \qquad (14)$$

which is positive when $\theta \leq \tau$. After jumping to its new steady-state path, the perfectly anticipated price of housing will grow at a constant rate each year. While the population growth rate is not (usually) a policy parameter, one can show that the policy of favoring housing over other assets ($\theta < \tau$) has two effects. First, the intergenerational transfer from future generations to current generations (through a jump in $V_t$) is larger the greater is the implicit subsidy to housing; this can be seen in equation (14) by noting that $\alpha/[\Delta(1+\delta)] < 1$. The

[14] Also see Henderson (1985) for models of urban growth.

second effect is that subsidizing housing is more costly in terms of revenue loss. Table 1 illustrates the impact on revenue of a shift in n. Column 3 reveals that when housing is taxed at the same rate as nonhousing capital, revenue is insensitive to the demographic change ($dR/dn = 0$). However, when housing enjoys preferential tax treatment (Column 2), demographic changes erode revenue substantially ($dR/dn = -15.2$). A policy which excludes housing from the tax base will both transfer more resources to current generations, and erode the tax base by more than a policy which includes housing in the tax base.

(B) "Two Period Models Can't Capture True Life Cycle Effects"

The magnitude of saving effects in a two period model may be overstated because the model implicitly assumes that everyone in the second period has a marginal propensity to consume of one. Younger homeowners would consume only a fraction of their housing appreciation. For example, suppose that housing prices jump by \$z; the net increase in life cycle wealth is only $\$z(1+r')^{-d}$, where $r'$ is the annual discount rate and d the remaining years of life (see, e.g., Poterba and Summers, 1987). To test for these n-period life cycle effects, I use a full 55 period partial equilibrium model of housing from Skinner (1989). Rental property is assumed to be a perfect substitute for housing; individuals rent while young and own their house while old. The housing price is endogenously calculated using iterative methods in a perfect foresight partial equilibrium model of housing and consumption. There are 55 generations alive at any moment, so when the tax regime is changed, some generations will unexpectedly gain, while others can lose. Upward sloping supply curves of housing are also assumed, with land remaining a fixed factor in the production of overall housing services.[15]

Consider an increase in effective annual tax on capital income from 37 percent to 55 percent. (This corresponds to an increase in inflation from zero to 4 percentage points.) Figure 1 describes the percentage change in revenue, and in net wealth held as housing and nonhousing capital, relative to the initial benchmark equilibrium. The initial impact of the tax is to increase the price of the existing housing stock. Over time, housing wealth decays as new generations purchase fewer units of the now more expensive housing. Nonhousing wealth declines as existing generations gradually spend their windfall housing wealth on consumption. Revenue initially rises (since the increased capital income tax is effectively a lump-sum tax on existing capital) but because of changes in saving behavior and the expansion of housing wealth, revenue ultimately declines in the medium run before rising to a long-run steady state revenue

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[15] It is assumed that individuals do not refinance their house, that the intertemporal elasticity of substitution is 0.5, maintenance costs are 5 percent of the value of the property, and the taste parameter for housing is 20 percent. See Skinner (1989) for a full discussion of other assumptions and parameter values used in the model.

gain. Despite an increase in the effective tax on nonresidential capital of 50 percentage points (from 37 to 55 percent), long-term revenue rises by only 12 percentage points.

The implied long-term saving elasticity is 0.44, which by empirical standards is high (see Boskin, 1978 and Hall 1988), but by simulation standards is low (e.g., Summers, 1981). The long-term marginal excess burden (defined here as the long-run compensating variation as a fraction of the increase in revenue) is in excess of *$10* per dollar collected. Even in 55 period life cycle models of consumption and housing demand, the wealth effects of shifts in interest income taxation are substantial, leading to large estimates for the marginal efficiency cost of capital income taxation.

(C) "The Results Depend Crucially on the Life Cycle Assumption"

As Calvo, Kotlikoff, and Rodriguez (1979) pointed out, whether current households spend down their windfall asset gains is crucial to the long-term effects of fiscal policy in the presence of land or fixed housing. If homeowners exhibited Barro-Ricardian utility functions, they would simply pass the housing capital gains along to their children so the children could afford the now more expensive housing.

There is mixed evidence on the Ricardian hypothesis of whether consumers who enjoy housing windfalls spend down their wealth, or save it to assist their children with the now more expensive housing services. Time series evidence lends support to the existence of life cycle wealth effects; the value of the housing stock in both the US (Hendershott and Peek, 1987; Bhatia, 1987) and in the United Kingdom (Muellbauer and Murphy, 1989) appears to be positively correlated with consumption. In particular, Mullbauer and Murphy suggest a model in which low returns on nonhousing assets boost housing wealth, which in turn depresses saving.

I found mixed evidence in a sample of non-moving homeowners from the Panel Study of Income Dynamics from the mid-1970s through 1981 (Skinner, 1989). While the pooled cross-section time-series regressions suggested that housing did affect consumption, the model with individual-specific effects implied no correlation between the two variables. Of course, the availability of home equity mortgages in the mid-1980s may have since made it easier to spend down housing wealth (Manchester and Poterba, 1989).

## V Evidence from U. S. Aggregate Data

The theory presented above has a number of strong implications for the pattern of housing and nonhousing wealth. Although it is difficult to conduct formal statistical tests using aggregate data, one can examine whether the broad trends in aggregate data are consistent with the theoretical model.

Household wealth in the United States is calculated by the Federal Reserve Board of Governors and the Bureau of Economic Analysis, and measured as of December 31st of each year (FRB, 1989).[16] Net wealth is comprised of financial assets, noncorporate equity, corporate equity, pension and life insurance assets, housing, and land, less total liabilities of the household sector. Financial wealth is calculated in current dollars, while corporate equities are measured by current market value rather than by net worth from the corporate balance sheets. Reproducible assets in noncorporate equity are valued at replacement cost, and land owned by businesses is assessed at market value. I exclude consumer durables from the measure of wealth because durables encompasses many commodities, such as bicycles and CD players, which are not usually considered to be part of the capital stock.

Housing and land wealth (which for expositional purposes I will refer to as housing wealth) is calculated for owner-occupied dwellings only. Structures are valued at replacement cost, and the land value is calculated by the Federal Reserve based on Censuses of Government for real estate assessments and sale price adjustments (FRS, 1990). Replacement costs may understate the value of housing structures; while the FRB calculates that aggregate owner-occupied wealth in 1985 was $3.41 trillion, Case and Shiller (1987), using evidence from resale housing prices, estimates total housing wealth to be $5.5 trillion.

In 1955, the ratio of housing wealth to national income was

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[16] The net wealth statistics also includes the assets of nonprofit institutions.

0.81, and the ratio of nonhousing wealth to income was 2.73. Figure 2 shows the subsequent changes in housing wealth, and a three-year moving average of nonhousing wealth (to smooth out year-to-year fluctuations caused primarily by stock market shifts), both expressed as a fraction of national income. Beginning at the 1955 base year, they travel in tandem until the early 1970s before sharply diverging; since that time, the ratio of housing wealth to national income has climbed to 0.28 above the 1955 value. The moving average measure of nonhousing wealth fell to a trough of -.56 below the 1955 level in 1978 before recovering to -.30 in 1988. Note that the ratio of total net wealth (housing plus nonhousing) to national income is nearly identical in 1988 to the ratio in 1955. The major shift here has been in the composition, and not the overall level, of wealth.

The rise in housing wealth could have been the result of simply building more houses. To test for this, housing wealth was also calculated on a constant price basis as the accumulated sum of net investment less depreciation, adjusted by the implicit GDP deflator.[17] The graph of this historical cost housing wealth measure with a starting point of 1955 is also shown in Figure 2.[18] This measure essentially follows (or is

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[17] An alternative deflator is the residential construction implicit price deflator. But the difference in the two measures is small; while the GNP deflator grew at an annual rate of 5.7 percent between 1965-87, the construction deflator grew at 6.3 percent.

[18] New owner-occupied housing investment was from the

slightly above) housing wealth measured at market value during the period 1955-70. The constant price housing wealth measure reflects cyclical variation of housing demand by the baby boom generation as children (the 1950s) and as parents (the 1980s), but shows no upward trend relative to national income.

The sharp divergence of housing and nonhousing wealth in Figure 2 is consistent with the model presented in Section II and the simulations shown in Figure 1. Inflation during the 1970s widened the divergence between $\tau$ and $\theta$. The short-run impact, say from 1970-74, was to stimulate housing wealth by 14 percent but reduce total net household wealth by 22.8 percent of national income. Over a more lengthy period, net wealth recovered to its previous level but the composition of wealth between housing and nonhousing assets was permanently altered. Obviously, there are other factors which can explain the pattern of wealth described above; the stock market lagged during the later 1970s and boomed during parts of the 1980s, and one disturbing part of the puzzle was that the rate of return on nonhousing assets during the 1980s was high. Nevertheless, the sharp shift in the pattern of wealth accumulation is striking in

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Quarterly Flow of Funds Accounts (various years) published by the Federal Reserve Board. I did not use the reported depreciation measures, since they would tend to overstate depreciation in calculating historical cost wealth measures. Instead, the reported ratio of depreciation to market value of housing (excluding land) was applied in each year to the constructed historical cost measure of the housing stock. The 1955 value of land was revalued by the implicit GNP deflator in each year.

light of the tax changes occurring at the same time.

## VI. Conclusion

This paper suggests that introducing a fixed asset such as housing to the standard two-period life cycle model implies a welfare cost measure of capital income taxation higher than previously thought. Taxing interest income both reduces the return on taxable capital income and increases the asset value of nontaxable fixed asset such as housing. Higher housing prices provide a windfall capital gain to current (older) generations at the expense of future (younger) generations who now must pay more for their housing. Because future generations must pay more for their housing, they may actually save more under a heavier capital income tax. Even if saving is completely insensitive to the capital income tax, housing wealth will crowd out nonhousing wealth, leading to a substantial erosion of the capital income tax base.

Some evidence for this crowding out effect is presented. Although the capital-income ratio has barely changed since 1955, the composition of wealth has tilted sharply towards housing wealth. But not all empirical evidence fits into the general pattern implied by the model. In Japan, land is a large fraction of national wealth, and land prices have been appreciating rapidly during the past few decades. The theory would predict that the Japanese saving rate should be low, but in fact it is very high. Furthermore, the asset pricing model has not been particularly successful in predicting stock market shifts in response to tax changes (Cutler, 1988; Downs and Tehranian, 1988).

The results derived above depend on the assumption of a life cycle model; that consumers spend their housing wealth down before they die. If consumers have Barro-Ricardo inter-generational preferences, then generations who benefit from higher house prices will leave more in bequests to assist future generations in purchasing the more expensive housing. The long-term impact of the shift in housing prices on saving depends on the extent to which families spend down the capital gains in their houses. But the figures in Section V yield little support for the notion that households are saving the accumulated housing wealth for future bequests; nonhousing wealth seems to be offset almost dollar for dollar by housing wealth. However, these measures are still relatively short-run in nature, and long-run capital accumulation patterns may ultimately differ.

Empirical evidence generally shows a weak link between tax policy and saving. The implications of the model presented above suggest that such findings, at least in the long run, may be perfectly consistent with highly inefficient tax policies towards capital income. The causal path by which tax policy affects productivity and aggregate real capital accumulation is more subtle; the existing tax policy soaks up national saving by increasing the asset price of existing housing and land, rather than by changing overall aggregate saving.

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## Appendix

This appendix provides first the general derivation for $V_t$ when n is different from land growth $\ell$, and then shows how $V_t$ shifts in response to changes in $\tau$ and $\alpha$.

General Expression for V: Using notation from the text, when $\ell$ is not equal to n,

$$V_t = \frac{\alpha Y(1+r^*)}{\Delta(1+\delta)h_t}\left[\frac{(1+a)(1+\ell)}{1+n} - 1\right]^{-1} \tag{A.1}$$

where

$$a = r^*\left[(1+\theta-\tau) - \frac{\alpha(\theta-\tau)}{(1+\delta)\Delta}\right]$$

Effect on V of $\tau$: After some rearrangement, it can be shown that

$$\frac{dV}{d\tau} = V\left[\frac{(1+r)^2 + (1+\delta)(1+r^*)(1-\theta r^*)}{(1+r)^2(\alpha + (1+\theta-\tau)[1+\delta+(1+r^*)(1+r)^{-1}])}\right] \tag{A.2}$$

Finally,

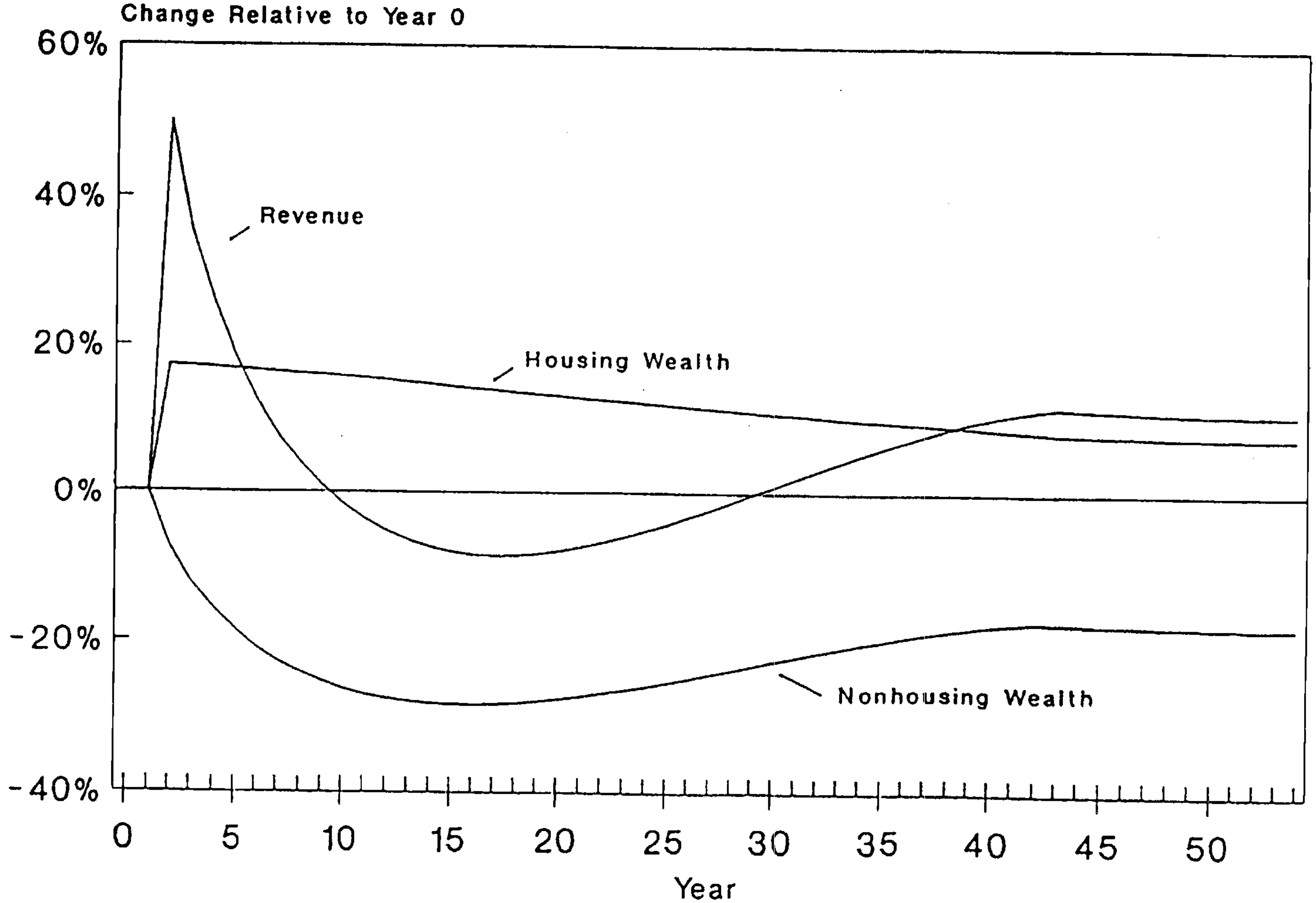
$$\frac{dR}{d\tau} = \frac{-dC_1}{d\tau}r^*\tau + (Y-C_1-V_1h)r^* + (\theta-\tau)r^*h\frac{dV_1}{d\tau} \tag{A.3}$$

Table 1: Effects of Taxation and Population Growth on Capital Accumulation, Revenue, and Utility

| | (1) $\theta = 0$ ($\alpha$ = .0001) | (2) $\theta = 0$ ($\alpha$ = .29) | (3) $\theta = \tau$ ($\alpha$ = .29) |
|---|---|---|---|
| Total Capital | 10.2 | 13.8 | 12.0 |
| Housing/Total Capital (percent) | 0.0 | 49.4 | 28.6 |
| $\frac{dK}{d\tau}$ | -9.3 | -2.5 | -7.0 |
| Revenue | 20.4 | 13.8 | 23.9 |
| $\frac{dR}{d\tau}$ (Long Run) | 19.2 | -3.4 | 17.5 |
| $\frac{dR}{d\tau}$ (Short Run) | 37.5 | 25.5 | 44.0 |
| $\frac{dU}{\lambda d\tau}$ (Long Run) | -6.9 | -15.3 | -8.8 |
| $\frac{dU}{\lambda d\tau}$ (Short Run) | 0.0 | 3.0 | 0.1 |
| $\frac{dV}{V d\tau}$ | 1.3 | 1.1 | 0.1 |
| $\frac{dR}{dn}$ | 0.0 | -15.2 | 0.0 |

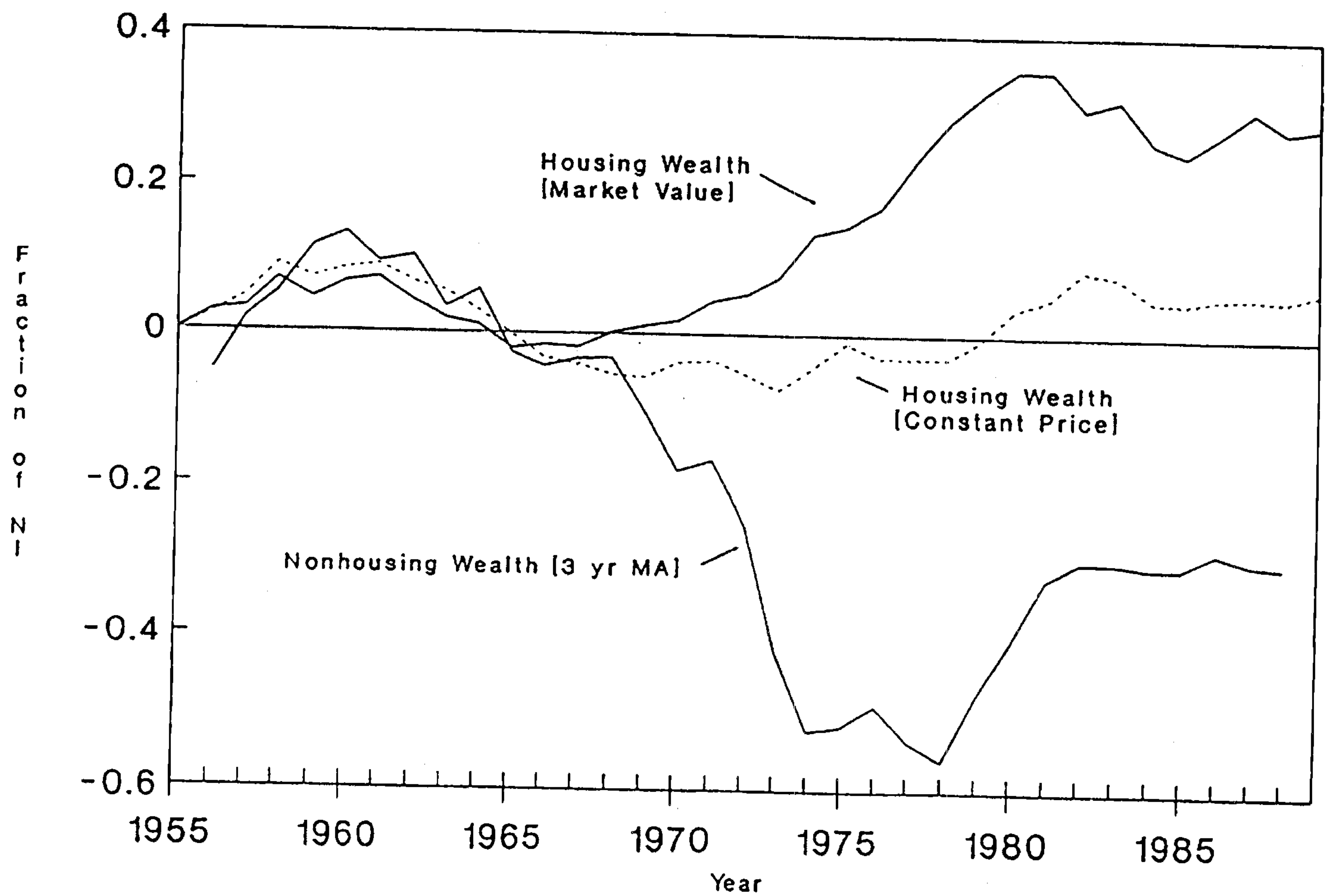
Notes: All values (except as noted) in thousands of dollars. Constant parameters are $r^* = 1.08^{20} - 1 = 3.66$; $r = 1.67$; $\tau = .54$; $\delta = 1.005^{20} - 1 = .105$; $Y = 30{,}000$; $n = 1.02^{20} - 1 = .486$.

## Figure 1: Simulated Changes in Housing and Nonhousing Wealth and Revenue




Note: Effective capital income tax rises from 37 to 55 percent in year 2.

Figure 2: Changes in Housing and Nonhousing Wealth Since 1955
[As a Fraction of National Income]




Sources: FRS (1990) Pubs. C.9 and Z.1.