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HOUSING WEALTH AND AGGREGATE SAVING

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ABSTRACT

The recent appreciation in housing value can have large effects on aggregate saving. This paper uses a simulation model to show that aggregate saving will decline substantially if life cycle homeowners spend down their housing windfalls. Homeowners with a bequest motive, however, may save more to assist their children in buying the now more expensive housing. To test whether families spend their housing capital gains, I use housing, income, and consumption data from the Panel Study of Income Dynamics. While a cross-section time-series regression implies that housing wealth does affect saving, a fixed-effects model finds no effect.

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I. Introduction

The price of a new single-family dwelling rose in real terms by 23 percent during the 1970s.[1] Much of this increase was concentrated in the western United States, where real house prices grew by 57 percent during a period of 8 years (Hendershott, 1987).

The standard life-cycle model predicts that homeowners will increase their consumption by some fraction of their capital gains in housing. Case and Shiller (1987) suggest that the total value of single-family housing in 1985 was about 5.5 trillion dollars, based on the mean price of $90,800 for an existing house. If homeowners consumed, say, 5 percent of their additional wealth (i.e., the increase in their "permanent income"), then the 23 percent increase in housing value would have caused aggregate consumption to rise by 51 billion dollars.[2] Holding income constant, this would have caused a 36 percent decline in personal saving. Hence the windfall in housing prices could have been a primary cause in the saving slowdown of the late 1970s and early 1980s.

One objection to this explanation is that a shift in the relative price of housing may not affect aggregate consumption. Any relative price increase implies that some gain (those selling the good), while others lose (those buying the good); usually, these effects wash out across the economy as a whole. That is, the positive wealth gain of homeowners could be exactly offset by the wealth loss of younger consumers saving for their dream home.

The exception to this rule is when the house lasts longer than does the homeowner. If there is a permanent increase in demand for the long-lived asset, the current owner can capture some of the future rent on the asset when it is sold to future generations. The question of whether the appreciation in housing prices should affect homeowners' consumption and saving therefore hinges on whether the expected life of their house and land exceeds their own planning horizon. In life cycle models, the answer is generally yes; current owners ultimately sell their house to younger generations. As with government debt in a life cycle model, current homeowners enjoy wealth and additional consumption at the expense of future generations (Feldstein, 1977; Chamley and Wright, 1987).

As with government debt, the expansionary effect of an increase in housing prices disappears in models with Barro-style utility functions; current homeowners internalize those higher future house prices by bequeathing more to future generations (Calvo, Kotlikoff, and Rodriguez, 1979). There is a strong similarity between the question of whether government bonds are net wealth and whether homeowners will spend their newly realized housing wealth.

This paper first describes the interaction between housing wealth and nonresidential wealth in an dynamic overlapping generations model of housing and consumption choice. The model numerically simulates the 60 year transition path of housing prices, saving, and consumption in response to an initial shift in housing demand. I allow for two exogenous changes as causal factors in the housing price increase of the 1970s; the interaction of taxes and inflation leading to a low user cost of housing (Hendershott, 1980; Poterba, 1984), and the increased pressure of population on inelastically supplied housing (Henderson, 1985; Mankiw and Weil, 1989). When bequests are ruled out, any housing price increase causes a substantial short-run decline in aggregate saving rates as homeowners spend down their windfall gains.

When the bequest motive is sufficiently strong, housing appreciation has little or no impact on aggregate saving. Homeowners bequeath the housing capital gain to help their children afford the more expensive housing. That is, whether housing price increases affect consumption and saving depends on the strength of the bequest function.

The second part of this paper uses the Panel Study of Income Dynamics to test whether shifts in housing value have any affect on the consumption (and saving) of homeowners. The empirical evidence is mixed; in standard consumption functions, house prices are estimated to have a small but significant impact on consumption. When corrected for individual heterogeneity, however, the link between housing prices and consumption disappears. Whether this finding supports a Barro-style model of intergenerational transfers, or whether it is indicative of constraints against borrowing by the elderly, is not clear.

Section II develops a computable model of housing demand, life cycle consumption, and bequests. Housing prices and supply are determined endogenously in a perfect foresight model with 55 generations. Calculations of the transition path in savings, housing value, and other factors are presented for tax and demographic changes. Section III describes the data from the Panel Study of Income Dynamics, and empirical estimates, while Section IV concludes.

II. A Model of Housing, Consumption, and Saving

There is a growing literature describing the effects of government policies on saving and welfare in the presence of fixed assets. Feldstein (1977) used an overlapping generations model to show that a newly imposed tax on land will reduce its market price by the full capitalized value of the land tax. This tax harms current owners of land, but benefits future owners (who can buy the land for less).[3] Related results have been found in a general equilibrium model of fiscal policy (Chamley and Wright, 1987), in international trade (Eaton; 1987,1988), and in development (Drazen and Epstein, 1988). However, Calvo, Kotlikoff, and Rodriguez (1979) have pointed out that the assumption of life cycle consumers is essential for these models; results often disappear in the presence of Barro-style bequest functions.

The model presented below solves for housing prices and saving in a dynamic partial equilibrium framework. Individuals live for a fixed lifespan of T years and retire after year R. They buy a house at age b, and live there until death; there are no borrowing (or downpayment) constraints. While the interest rate and wage rate are assumed fixed, the asset price of housing capital (and the spot price of housing services) are determined endogenously.

The timing of the model is as follows. Individuals begin the year with assets A_i which earn the constant net after-tax rate of interest r.

At the end of the period, earnings and interest income are received, rental housing services are purchased, and consumption choices are made. What remains is passed to the next period either as assets, or as bequests to the most recently born generation. Dropping the time subscripts for the moment, the utility function is

$$U = \sum_{i=1}^{T} (1+\delta)^{1-i} \ln[h_i^{\alpha} C_i^{1-\alpha}] + (1+\delta)^{1-T} \beta_0 \ln(B - \beta_1 Q_{T+b}) \qquad (1)$$

where δ is the rate of time preference, h_i and C_i are the flow of housing services and consumption at age i, and α is the expenditure share on housing at any age. The bequest function depends on the level of the bequest, B, as well as the price per unit of housing asset, Q_i, faced by descendants who are born at the beginning of year T+1 and who must buy their house at the end of year T+b. The bequest function encompasses a life cycle model ($\beta_0 = 0$), a traditional bequest function ($\beta_1 = 0$, $\beta_0 \neq 0$), and an approximation to a dynastic bequest model ($\beta_0, \beta_1 > 0$) in which the current generation is concerned about the future price of housing.

To approximate the fixed costs involved in switching houses, it is assumed that individuals buy their house at age b, and live there until death ($h_i = h_b$, $i > b$). The down payment is a proportion ψ of the market value of the house, $Q_b h_b$. Individuals rent property at an age less than b, and adjust the size of their rental property costlessly from year to year.[4] The budget constraint is written

$$\sum_{i=1}^{T} [C_i + P_i h_i](1+r)^{1-i} + B(1+r)^{1-T} = [I_1 + \sum_{i=1}^{T} (Y_i+G_i)(1+r)^{1-i}]$$

$$+ \sum_{j=b}^{T}(P_j(1-\theta-m)h_b(1+r)^{1-i} + Q_{T+1}(1+r)^{1-T}h_b - \psi Q_b h_b(1+r)^{1-b}$$

$$- (1-\psi)Q_b h_b \sum_{i=b}^{T} r(1+r)^{1-i} - (1-\psi)Q_b h_b(1+r)^{1-T} \qquad (2)$$

where P_i is the (spot) price of rental housing, m is the maintenance costs incured by the property owner (assumed proportional to the spot price), I_i, Y_i, and G_i are inheritances, earnings, and government rebates at age i, r is the net return paid on the mortgage as well as the interest rate used to discount all future income and expenditures, and θ is the net tax (or subsidy) on housing services. I abstract from the issue of whether rental or owner-occupied housing has enjoyed more favorable tax treatment, and assume that they are perfect substitutes in production and that each enjoys the same (preferential) tax advantage θ (Gordon, Hines, and Summers, 1987).

The left side of equation (2) measures full expenditures on housing and consumption, while the right side of (2) reflects lifetime income; the present value of inheritances, earnings, government rebates, the returns on housing (the net service flow plus the sale price) minus the costs of housing (the downpayment, mortgage payments, and the repayment of the principal). By the arbitrage condition, we know that in a model of perfect foresight,

$$Q_t = \sum_{j=t}^{\infty} P_j(1-\theta-m)(1+r)^{t-j-1} \qquad (3)$$

Using (3), (2) reduces to

$$\sum_{i=1}^{T} [C_i + P_i h_i](1+r)^{1-i} + B(1+r)^{1-T} = [I_1 + \sum_{i=1}^{T} (Y_i+G_i)(1+r)^{1-i}] \qquad (2')$$

It is straightforward to derive the first order conditions;

$$C_i = \left[\frac{1+r}{1+\delta}\right]^{i-1} C_1 \qquad (4)$$

$$h_i = \frac{\alpha}{1-\alpha}\left[\frac{1+r}{1+\delta}\right]^{i-1} (C_1/P_i), \ i < b.$$

$$h_i = \frac{\alpha}{1-\alpha} C_1 \left[\frac{(1+\delta)^{2-b} - (1+\delta)^{1-T}}{\sum_b^T P_j(1+r)^{1-j}}\right] \quad i \geq b$$

$$B = \left[\frac{1+r}{1+\delta}\right]^{T-1} [\beta_0/(1-\alpha)]C_1 + \beta_1 Q_{T+1}$$

The derivations above have described consumption, housing, and bequests for the steady state. Once a change occurs in the economic system, generations along the transition path will differ from one another, depending on their age at the time of the change. The generalized solution to consumption in year t at time i is expressed as

$$C_{it} = D^{-1}\delta(1-\alpha)\left[A_{it}(1+r) + \sum_{0}^{T+1-i} [Y_{i+j,t+j} + G_{i+j,t+j} - \zeta h_b P_{t+j}](1+r)^{-j} - (1+r)^{i-T}\beta_1 Q_{1+T+t-i}\right] \qquad (5)$$

where $D = (1+\delta) - [(1+\delta)^{i-T} + \delta(1+\delta)^{i-T}\beta_0]/(1-\zeta\alpha)$

and $\zeta = 1$ for homeowners (in which case the consumption choice is constrained give the chosen quantity of housing) and $\zeta = 0$ for renters ($i < b$). It is straightforward to derive the equivalent expressions for housing and bequests as functions of consumption.

The aggregate capital stock, which includes owner-occupied and rental housing, is expressed as $\bar{A}_t = \sum_{i=1}^{T} A_{it}(1+n)^{1-i}$, where n is the rate of population growth. The non-residential capital stock is

$$V_t = \bar{A}_t - Q_t(H_t + S_t),$$

and H_t and S_t are the aggregate quantity of owner-occupied and rental housing. The distribution of ownership of rental property is assumed to be in proportion to total assets (less owner-occupied housing) held by the population, so individuals at year t and age i own $[A_{it} - \xi Q_t h_{i,t}] \times [Q_t S_t/(\bar{A}_t - Q_t H_t)]$ of rental property.[5] It is necessary to assign ownership because changes in rental property asset values will also have wealth effects for current individuals.

Supply of Housing

To allow for an upward-sloping supply of housing, land is introduced as a fixed factor in the production of housing units. Land is assumed to grow at an exogenous rate ν; in the initial steady state, land growth ν is equal to population growth n. When land growth is slower than population growth, the price of housing will rise gradually over time. The housing production function is given by

$$X_t = H_t + S_t = \Omega K_t^{\gamma} L_t^{1-\gamma} \tag{6}$$

where Ω is the technological parameter, K_t physical capital invested in housing at time t (with assumed zero depreciation rate), γ the share parameter, and $L_t = L_0(1+\nu)^t$ is the exogenously given supply of land. One unit of housing X_t produces one unit of housing service h_t. The marginal condition that the cost of a unit of housing is given by the marginal cost of producing a new unit (i.e., Tobin's "Q" = 1) is

$$Q_t = \frac{\gamma K_t}{H_t+S_t} \tag{7}$$

The elasticity of the housing stock with respect to the price Q_t (holding land constant) is $\gamma/(1-\gamma)$. Note that a "reasonable" factor share of land, such as $1-\gamma = .25$, implies a large housing stock elasticity of 3.0. Converting the housing stock elasticity to a housing investment elasticity (where investment is assumed to be 10 percent of the stock) yields a measure of 30, which is clearly much larger than empirically observed investment elasticities. This may be a consequence of assuming that the elasticity of substitution is one; empirical evidence suggests an elasticity between .3 and .7 (Kau and Sirmans, 1981). To compensate, I assume a lower value of γ than that implied by factor share payments.

Government and Bequests

The government sector collects revenue from individual i at time t equal to

$$G_{it} = \theta P_t h_{it} + r^* \tau (A_{it} - Q_t h_{it}) \tag{8}$$

and r^* is the gross rate of return and τ the tax on interest income. The government collects revenue and returns the entire amount G_{it} to each individual, in each year. This age- and year-specific lump-sum rebate therefore avoids any cross-generation transfer of tax revenue, or accumulation of government capital or debt.

Bequests and inheritances are normalized so that the bequests given by individuals at death at the end of year t are equal to $(1+n)^{1-T}$ times the inheritances received by people born at the beginning of year t+1.

Convergence Method

It is not difficult for iteration methods that solve dynamic rational-expectations models to veer off far from the equilibrium path (see Lipton, et al, 1982). The method used below uses the condition that Q_t is equal to the marginal supply cost of new housing capital. The initial balanced steady state is first calculated for $n = \nu$, and all relative prices are constant over time. A permanent change is made, either in the relative population/land growth rate or the tax regime. An initial guess of the new vector of yearly prices $\{P_t\}$ is made, as well as the corresponding vector $\{Q_t\}$, where each element of $Q_t = \sum_t^{\infty} P_j(1-\theta-m)$. The actual calculations take place only from year 0 to year 60; beyond that point steady-state properties of the future prices are used to allow calculation of Q_t.

Given the guess of $\{Q_t\}$ and $\{P_t\}$, individuals make consumption and housing choices, which in turn imply a vector of aggregate housing $\{X_t\}$ in each year. A new vector, $\{\hat{Q}_t\}$, is then calculated which is the supply price of housing necessary to generate the quantity of housing demanded. If $\{\hat{Q}_t\} = \{Q_t\}$, then the system has converged; the quantity of housing demanded given $\{Q_t\}$ and $\{P_t\}$ is equal to the quantity supplied. If not, then each price P_t is adjusted from its previous level depending on the value of $\hat{Q}_t - Q_t$. The convergence measure worked well for all the cases considered, although it was quite slow when a bequest function was allowed, because shifts in estimated Q_t affected bequests b years before, which in turn would affect prior consumption and housing choices.

Empirical Parameters

In the numerical calculations that follow, I assume that the net after tax rate of return is 4 percent, the time preference rate is 2 percent, the population growth rate 2 percent, and the cost of maintenance 20 percent of P_t. King and Fullerton (1984) calculate an effective tax rate τ equal to 37 percent. While the subsidy to homeownership varies with marginal (or average) income tax brackets, I will assume that $\theta = 0$ in the initial equilibrium; the return to homeownership is simply untaxed.

Individuals are assumed to live for 55 years, and retire after 45 years. The earnings path for a white high-school graduate is taken from Lillard (1983), and all figures are expressed in thousands of dollars. Houses are purchased in year 30, and the housing preference parameter α is set at .29; this is the ratio of housing expenses to total expenditures from the Consumer Expenditure Survey in 1980 (Statistical Abstract, 1987, p. 430). The production parameter γ is assumed to be .1, which yields an elasticity of supply for the stock of housing equal to .11; if, for example, investment is 5 percent of the total stock, the investment elasticity is 2.2, a measure consistent with the long-run housing elasticity (Topel and Rosen, 1988). The production parameter Ω was calculated by normalizing $P = 1$ in the initial steady state.

The parameter β_1 is predetermined to approximate $\partial V_t/\partial Q_{t+b}$, where V_t is the generation t indirect utility function. From the direct utility function, and denoting $\bar{h}$ as the steady state value of housing, $\beta_1 = \bar{h}(1+r)^{1-b}(1+n)^{1-T}$, which turns out to be roughly 8.0 for the base case simulations. For reasons of stability, the model does not allow for a full Barro-style utility function; $\beta_0 = 0.5 < 1.0$.

There are a number of explanations for the jump in housing prices during the past two decades. The first explanation is based on the interaction of high inflation rates and the taxation of nominal interest income which led to negative real after tax interest rates during the late 1970s (Feldstein, 1980; Summers, 1981). Poterba (1984) developed a dynamic model of housing with variable supply, and explained much of the increase in housing value during the late 1970s as a consequence of the high effective tax rate on nonresidential investment. The most obvious way to replicate the experience of the 1970s is to increase τ while holding θ constant. The problem with this experiment is that it confounds the effect on consumption of an interest rate shift with the effect of housing price shifts. Both will lead to a sharp decline in saving rates. To hold the interest rate effect constant (so the net interest rate is fixed), the housing tax differential is increased by 20 percent by shifting from $\theta = 0$ to $\theta = -.20$.

The taxation explanation alone cannot successfully explain the pattern of housing prices in the 1980s (Hendershott, 1988). Despite the substantial fall in inflation rates and marginal tax rates, housing prices have fallen only slightly, and in some areas have continued to rise (Case and Shiller, 1987). A second explanation focuses on demographic changes which increased the number of potential renters and homeowners during the 1970s and early 1980s. Between 1975 and 1985, the population expanded by 11 percent, while the number of households increased by 22 percent. Standard urban models imply that the price of scarce land/housing conveniently close to employment centers will be bid up as households or population grows (Henderson, 1985). Mankiw and Weil (1989) argue that it was the increased housing demand by baby boomers that led to the sharp rise in housing prices during the late 1970s. To capture general demographic effects in this model, I assume that the growth rate of land ν falls permanently behind the growth rate of population n.[6] That is, the per capita supply of land (and, over time, housing) declines, and housing prices rise, as population growth exceeds land growth. The reason why land growth is reduced rather than population growth increased is to hold constant the age composition of the population. Increasing population growth will increase the relative number of young people, which by itself will increase aggregate saving rates in life cycle models.[7]

Simulation Results

The simulation model was calculated for both the life cycle case (with no bequest motive) and for the bequest case. Figure 1 displays the impact on house prices of reducing θ from 0.0 to -0.2. Paths (A) and (B) show the housing price shift for the life cycle (LC) and bequest (Beq) cases respectively. The effect of taxation on housing prices depends only marginally on whether homeowners have a bequest motive; housing prices jump by roughly 16 percent and settle close to their new steady state values.

The aggregate saving rate in the simulation model is patterned after the national income accounts measure of saving. Income is earnings plus the return on housing (P_tX_t) and nonhousing capital, and government rebates, while saving is income less consumption less housing expenditures. Initially, the aggregate saving rate in the economy with a bequest motive (20.5 percent) is higher than the saving rate in a life cycle economy (15.3 percent).

Figure 2 shows the change in the aggregate saving rate as a consequence of the housing subsidy. In the life cycle case (A), aggregate saving declines by 6.1 percentage points as current generations spend down their windfall; over time the saving rate declines permanently by 2 percentage points. While the saving rate for the economy with a bequest motive still declines (B), the magnitude of the change is only one-third that for the life cycle economy. In the long-run, the saving rate is 1 percent below the initial steady state value. The bequest function dampens and can potentially offset the life cycle response to the housing price appreciation.

The converse of the policy presented above is to increase the implicit tax on housing services. One possibility, for example, is to assess a tax on estimated housing service flows. Separate simulations (not reported) indicate that short-run saving rates would rise (substantially in the life cycle case, less so with a bequest motive) in response to the equalization of capital taxes on housing and nonhousing capital (i.e., $\tau = \theta$).

The impact of an increasing pressure of population on land (i.e., a reduction in the growth rate of land by 0.5 percent) is to raise housing prices by 15 percent for both the life cycle (C) and bequest (D) model (Figure 1). Given that the per capita stock of land is falling over time, the perfectly foreseeable housing price will grow at a constant rate in each year. Aggregate saving rates shifts in response to the housing price changes are shown in Figure 2 for the life cycle model (C) and the bequest model (D). Once again, a housing price appreciation causes current life cycle homeowners to spend down their wealth, thereby reducing aggregate saving. However, a housing price appreciation causes homeowners with a bequest motive to permanently <u>increase</u> their saving to provide for their childrens' more expensive housing.

The long run impact of housing prices on capital accumulation depends on the behavior of the consumers who enjoy the windfall housing profits; do they spend down their capital gains or save them? To measure the behavior of this group, I turn next to an empirical test of the impact of house value on consumption and saving.

III. Empirical Estimates of Housing Value and Saving

A number of time-series studies have estimated that housing wealth has a positive effect on consumption. In particular, the coefficients from Bhatia (1987) and Hendershott and Peek (1987) suggest that the marginal propensity to consume out of housing wealth is between 4 and 5 cents. Krumm and Miller (1986) used the Panel Study of Income Dynamics (PSID) to compare the changes in asset income of homeowners with renters. While nonhousing saving fell temporarily following a house purchase, homeowners on average saved more in nonhousing assets than renters, holding income constant. Their evidence is consistent with individual-specific saving effects; those who save are also more likely to buy houses.

The empirical analysis below also uses the PSID to test the effect of housing windfalls on consumption. The primary sample was selected in the following way. Observations were excluded if (i) there were changes in the composition of family heads during the years 1973-83; (ii) families rented or had moved during the period 1976-81; (iii) there were missing values for selected variables; (iv) the reported house value was less than $4000, and (v) if income during any year 1973-81 was equal to zero or exceeded $99,999. One-thousand and fifty-six families remained in the primary sample.

In the past, researchers have used food consumption in the PSID as a proxy for total consumption. It is straightforward, however, to take advantage of alternative consumption indicators reported in the PSID to construct a better measure of consumption (Skinner, 1987). In particular, the survey reports utility payments, restaurant spending, food at home, and the number of automobiles.[8] These expenditures correspond to categories in the Consumer Expenditure Surveys (CEX) of 1972-73 and 1982. The strategy used here is to regress total consumption in the CEX on these independent variables; the regression coefficients are then used to weight the corresponding PSID variables to generate predicted total consumption. Using the full set of consumption indicators increases the explanatory power from as little as 26 percent of total variance (using food consumption alone) to almost 60 percent with the full set of variables.[9]

From the Consumer Expenditure Surveys of 1972-73 and 1982, the dependent variable, consumption, was constructed to be total consumption expenditures less automobile and furniture purchases and mortgage payments, plus an imputed 6 percent return on the house value.[10]

The regression to predict consumption from the 1972-73 Consumer Expenditure Survey, which used annual data, is

$$\underset{(36)}{C = 1935} + \underset{(59)}{1.29*Food} + \underset{(82)}{3.32*Away} + \underset{(21)}{680*Auto} + \underset{(37)}{2.97*Utility}$$

$R^2 = .59$; $N = 14499$

where t-statistics are in parentheses, Food measures food expenditures at home, Away measures food away from home, Auto is the number of automobiles up to a maximum of 2, and utility measures utility payments. Using similar notation, predicted consumption from the 1982 Consumer Expenditure Survey (on a quarterly basis but adjusted to annual terms) is

$$\underset{(9)}{C = 2173} + \underset{(25)}{1.63*Food} + \underset{(38)}{3.62*Away} + \underset{(12)}{1914*Auto} + \underset{(21)}{2.60*Utility}$$

$R^2 = .59$; $N = 3431$

Predicted consumption was constructed using both the 1972-73 and the 1982 survey results, with appropriate adjustments using the CPI. Average consumption for the sample is presented in the 5th and 6th columns of Table 1. All consumption and income variables used in the PSID regressions are in terms of constant 1981 dollars.

The survey asked for the respondent's subjective value of their house in each year (presumably consumption decisions are based on the subjective value of the house). The average house value is presented in

Table 1. In nominal terms, housing valuation increased by 76 percent; when deflated by the CPI, housing prices increased by only 10 percent. However, the CPI is likely to overstate the true cost of living increase for homeowners, since it accounts for higher house prices facing prospective homeowners. An alternative measure is the GNP deflator; using this adjustment, house prices rose by 18 percent during 1976-81; during the period 1976-80, housing prices increased at an average annual rate of 4.3 percent in real terms.

As a first exploratory step in measuring the impact of housing prices on consumption, it is useful simply to regress the individual log difference in consumption between 1976 and 1981 on the log difference in income and the log difference in house value. Because the sample is restricted to those who did not move, the change in house value should correspond to asset revaluation of an existing structure, although the individual may have added home improvements (or allowed the house to depreciate). The regression yielded the following coefficients (with t-statistics in parentheses);

$$\dot{C} = \underset{(7.6)}{-.059} + \underset{(8.1)}{.133\dot{Y}} - \underset{(0.6)}{.010\dot{h}} \qquad R^2 = .079 \tag{9}$$

That is, the simplest model implies that individuals' consumption patterns are sensitive to income changes ($\dot{Y}$) but not to changes in housing valuation ($\dot{h}$). One potential objection to this regression is that consumption should respond only to the unpredictible component of housing price changes. To separate the unpredictable from the predictable components of housing price changes, I assume that homeowners forecast future price changes with an AR(2) model. Using 1976-78 data yields a predictive equation equal to $\ln(h_t) = .654 + .521\ln(h_{t-1}) + .423\ln(h_{t-2})$ with t-statistics of 3.8, 17.8, and 14.4, respectively; $R^2 = .77$. The predicted change in the housing price between 1976 and 1981 (calculated using the AR(2) model) is denoted by $\hat{h}$, the unexpected change by $\tilde{h}$. It is interesting to note that the average value of $\tilde{h}$ was less than zero, suggesting that the house prices in 1981 may not have been unanticipated. A regression similar to Equation (9) was run with $\hat{h}$ and $\tilde{h}$ entered separately;

$$\dot{C} = \underset{(5.5)}{-.054} + \underset{(8.1)}{.133\dot{Y}} - \underset{(1.0)}{.032\hat{h}} - \underset{(0.1)}{.003\tilde{h}} \qquad R^2 = .060 \tag{10}$$

It seems clear that changes in housing prices, whether expected or unexpected, do not have a large impact on consumption in these simple regressions. One hypothesis would be that the bequest motive just offsets the life cycle wealth effect, so that saving is left unchanged. A test of this "weak bequest" hypothesis is to include a variable ($\dot{h}$ × family size); if the bequest motive were stronger for families with more children, one might expect this coefficient to be negative. However, the variable is insignificant.

The next step is to take advantage of the full data set by forming a combined cross-section time-series data set. From the theoretical model, it can be shown that the main determination of consumption is lifetime wealth (or permanent income). I attempt to provide an accurate measure of permanent income by including (logged) current income, current earnings,[11] three years of lagged income, and next year's income. An accurate measure of lifetime wealth is particularly important in this equation, since housing purchases are likely to be highly correlated with lifetime wealth (some consumption studies in the past have even used housing value as a proxy for permanent income!). While the life cycle model implies that the marginal propensity to consume out of lifetime wealth is a function of age, interactive terms of income with age were insignificant, and were therefore excluded. To adjust for demographic effects, age, age^2, the sex of the household head, and family size were included in the regression. Finally, the dependent variable, log(consumption), is constructed using the 1982 weights, although the regression results were similar when the 1972 weights were used.

A parsimonious regression is presented in the column labeled (1) in Table 2. The impact of a temporary change in (log) income on current (log) consumption is 0.06, which is roughly consistent with the predictions of a life cycle model for a younger individual. The predicted change in consumption as a result of a permanent (5 year) change in income, .22, is less than that predicted by the life cycle model. The coefficient on the house value is significant; it implies that a 23 percent increase in the market value of housing would increase consumption by 1.4 percent.

One disadvantage with the model in Column (1) is that it potentially confounds two effects. If interest rates affect both housing prices and consumption directly (through the Euler equation), the coefficient on housing could confound these two effect. Furthermore, business cycles could both depress housing prices and increase consumption (conditional on income), leading to further bias. To measure the direct impact of interest rate changes, dummy variables for each year are also included in the column labeled (2). Conditional on lagged, current, and future income, consumption rates were higher during the late 1970s, a period of low real after-tax interest rates.

The pooled cross-section time-series regression coefficients from column (2) suggest that a rise in real housing prices of 23 percent is predicted to reduce consumption by 1.4 percent. Since these figures apply only to homeowners, the estimate must be adjusted before applying it to aggegate assumption. Noting that 64 percent of all housing units were owner-occupied in 1983, and that homeowners enjoyed a median family income double those who rented in 1983 (Statistical Abstract 1987, p. 712). Then the adjusted drop in aggregate consumption is predicted to be $26 billion in 1985 (or 18 percent of personal saving), assuming that (a) consumption is proportional to income and (b) renters' consumption is unaffected by housing prices. The measured effects are somewhat less than those implied by the pure life cycle model.

Correcting for Heterogeneity among Homeowners

Heterogeneity may affect these estimates for two reasons. First, there may be some selectivity bias from choosing only those who did not move for the entire period. If, for example, those individuals with consumption most responsive to housing wealth are also most likely to "cash out" their house (by moving to a less expensive house in another region, for example), then restricting the sample to "stayers" will bias the results. The standard Heckman method is used to adjust for this bias; the inverse Mills ratio for "stayers" is calculated from a probit which explains whether individuals move or not.[12] This ratio is then interacted with the housing wealth variable and entered independently in the regression on consumption; results are presented in Table 2, Column (3). The interactive term is positive implying that the larger the unobservable component that predicts the family will move, the higher the inverse Mills ratio, and hence the smaller the response of consumption to housing value. This interactive term alone is not significant, although the joint test that both the Mills ratio and the interactive term are zero is rejected at the 0.01 level ($F(2,6317) = 16.57$).

A second source of heterogeneity is that some individuals in the sample may be "spendthrifts" who both consume more relative to income, and live in larger houses. Hence including house value on the RHS could lead to a spurious correlation, since both consumption and housing will reflect the unobservable heterogeneity. To correct for this correlation between the unobservable effect and the independent variables, a fixed effect model of consumption is estimated. Individual effects are removed from the least squares regression by subtracting each variable's household-specific (arithmetic or logrithmetic) average. This is equivalent to including a dummy variable for each family in the regression. Because of this, variables which are constant for each family over time, such as sex or the Mills ratio, are excluded from the regression. Column (1) in Table 3 reports regression results for a simple model explaining log consumption as a function of a limited number of variables. While income and family size remain signficant, house value does not have a signficant effect on consumption. The second regression reports results for the model including year dummies; once again there is no evidence that house value has an effect on consumption.

What can one conclude from these sets of regressions? One interpretation would be that house value has no impact on consumption, and that regressions from Table 2 (which imply that house values do affect consumption) reflect spurious correlation between the two variables. However, the fixed effect regressions may not be as statistically powerful as the non-fixed effect regressions, since the former are based only on within-family variation, and ignore potentially useful variation between families.

IV. Conclusion

This paper has suggested that the rise in housing prices during the past decades can have an important impact on long run capital accumulation. In particular, if consumers follow life cycle patterns of consumption, the increased house values is predicted to reduce saving rates in theoretical models with rational expectations and perfect foresight. The saving effects are moderated in the presence of a bequest motive; individuals concerned about their children facing higher housing prices leave larger bequests rather than spending their windfall gains.

The Panel Study of Income Dynamics was used to assess the impact of housing values on consumption. While one set of regressions suggested a small but significant effect, another set which corrected for individual differences across families suggested that shifts in house value had no effect on consumption during the later 1970s.

What light do these results shed on the theoretical models of saving behavior? The latter regressions support Ricardian equivalence; homeowners do not consume their housing wealth. But consumers may be _unable_ to spend down their housing wealth. While second mortgages are an increasingly popular method for unlocking housing equity (Manchester and Poterba, 1987), retirees may face difficulties in meeting mortgage payments. There are few reverse annuities that allow elderly homeowners to spend part of their housing equity (Manchester, 1987). Another possibility is that consumers do not view their capital gains as permanent. Current homeowners may not wish to risk an over-leveraged house if prices do ultimately fall. Finally, homeowners may have grown accustomed to an accelerating pattern of housing price increases, so that the house price changes anticipated for the late 1970s were already reflected in 1976 (and later) consumption choices.

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Table 1: House Value and Real Consumption 1976-81: Non-moving Homeowners

Year	House Value (Nominal)	House Value (GNP Def.)	House Value (CPI Def.)	Consumption (1972-73 Coeffs) [CPI]	Consumptions (1982 Coeffs) [CPI]
1976	30,772	45,860	49,157	17,905	17,331
1977	34,608	48,335	51,964	18,195	17,618
1978	39,158	50,987	54,614	18,403	17,857
1979	43,919	52,535	55,036	18,090	17,468
1980	49,696	54,491	54,852	17,924	17,164
1981	54,161	54,161	54,161	17,010	16,191

N = 1056. All real prices expressed in terms of 1981 dollars.

Table 2: Consumption Regressions 1976-81

	(1)		(2)		(3)	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
Income_{t-3}	.0361	5.29	.0396	5.79	.0402	5.90
Income_{t-2}	.0273	3.87	.0283	4.01	.0285	4.04
Income_{t-1}	.0450	5.74	.0438	5.58	.0436	5.58
Income_{t}	.0672	8.59	.0650	8.13	.0645	8.09
Income_{t+1}	.0444	6.97	.0427	6.68	.0411	6.45
House Value	.0625	11.71	.0622	11.66	.0650	3.63
Age	.0085	5.59	.0084	5.35	.0094	5.95
Age^2	-.102E-3	7.00	-.996E-4	6.41	-.109E-3	6.96
Family Size	.0448	22.83	.0447	22.73	.0477	23.48
Sex (1 if female)	-.1159	11.57	-.1170	11.66	-.1108	11.01
Earnings			.0004	0.34	-.0005	0.34
YR1976			.0345	3.36	.0346	3.37
YR1977			.0500	4.87	.0503	4.91
YR1978			.0616	6.01	.0618	6.05
YR1979			.0483	4.74	.0486	4.77
YR1980			.0441	4.33	.0442	4.35
Mills Ratio					.0106	0.05
Mills × Hse Val					.0044	0.21
C	6.5114		6.4780		6.4828	
R^2	.487		.525		.528	

Note: N = 6336. Dependent variable is the log of consumption (1982 weights).

Table 3: Consumption Regressions With Fixed Effects, 1976-81

	(1) Coeff.	(1) t-stat.	(2) Coeff.	(2) t-stat.
$Income_t$	.0478	8.52	.0412	7.44
House Value	-.0004	0.06	-.0107	0.50
Family Size	.0425	11.89	.0341	9.34
YR1976			.0537	8.24
YR1977			.0703	10.89
YR1978			.0822	12.79
YR1979			.0663	10.42
YR1980			.0543	8.58
Mills × House Value			-.0091	0.37
C	.0000		-.05447	
R^2	.039		.068	

Notes: N = 6336. Family-specific means removed from each of the independent variables (except the year dummies) as well as from the dependent variable, the log of consumption (calculated using 1982 weights).

[1] The price of housing is assumed to be the price index for new single dwelling structures, adjusted by the GNP deflator.

[2] Time-series estimates of the effect of housing inclusive wealth on consumption are 4.6 cents (Bhatia, 1987) and 4.0 cents (Hendershott and Peek, 1987) per dollar.

[3] Since the land tax is rebated, the tax inclusive price of land for a particular generation falls. Alternatively, the owners of the land make no profit on the land but they enjoy the proceeds of the lump sum rebate.

[4]The PSID reports that in the total sample, roughly 20 percent of renters move to a new location each year. For the sample of homeowners in 1976/77, only 27 percent moved at any time during the four year period 1978-81. See Ioannides (1987) and Henderson and Ioannides (1987) for a more general model of housing tenure choice.

[5] If rental property exceeds non-owner-occupied capital, the limit is set to one.

[6] The model captures a permanent perfectly anticipated change in housing prices. In Mankiw and Weil (1989), the demographic change is temporary, but because individuals appear to be myopic, they treat the change as if it were permanent.

[7] There are other explanations for the housing price increases. Case (1987) suggests that a speculative bubble is the only factor that can explain the sharp jump in Boston housing prices. Hendershott (1988) favors an explanation in which a slowdown in housing construction productivity leads to a secular rise in housing prices.

[8] One disadvantage with using utility payments is that the real price of gas and electricity grew by 33 percent during the 1970s.

[9] Similar regressions are reported in Skinner (1987). In those regressions, however, house value was used as a consumption indicator,

which is clearly not appropriate for this exercise.

[10] It might appear that the imputed housing flow will contaminate this measure of total consumption. However, the instruments used to predict consumption are independent of changes in housing values, so the consumption measure will not bias the results.

[11]The log of earnings was set to zero when earnings were zero.

[12]The probit equation for whether individuals moved or not is

$$\begin{aligned} M = \; & \underset{(3.1)}{-2.47} - \underset{(0.6)}{.045\Delta Y} + \underset{(2.0)}{.034\Delta Earn} + \underset{(7.0)}{.271\Delta Fmsz} + \underset{(0.2)}{.005(H/Y)} \\ & + \underset{(2.0)}{.162Y} + \underset{(1.8)}{.028Earn} - \underset{(0.1)}{.002Fmsz} \qquad N = 1465 \end{aligned}$$

where M is the probit index as to whether the family moves during 1976-81, Y is log of income, Earn is earnings, Fmsz is family size, H/Y is the ratio of 1976 housing value to 1976 current income, and Δ denotes changes over the 5 year period. This sample is expanded to include those who owned a house during 1976 and 1977, but who may have moved or sold their house between 1978 and 1981. There were 393 movers and 1072 who stayed. See Venti and Wise (1987), Ioannides (1987), and Henderson and Ioannides (1987).

Figure 1: House Prices

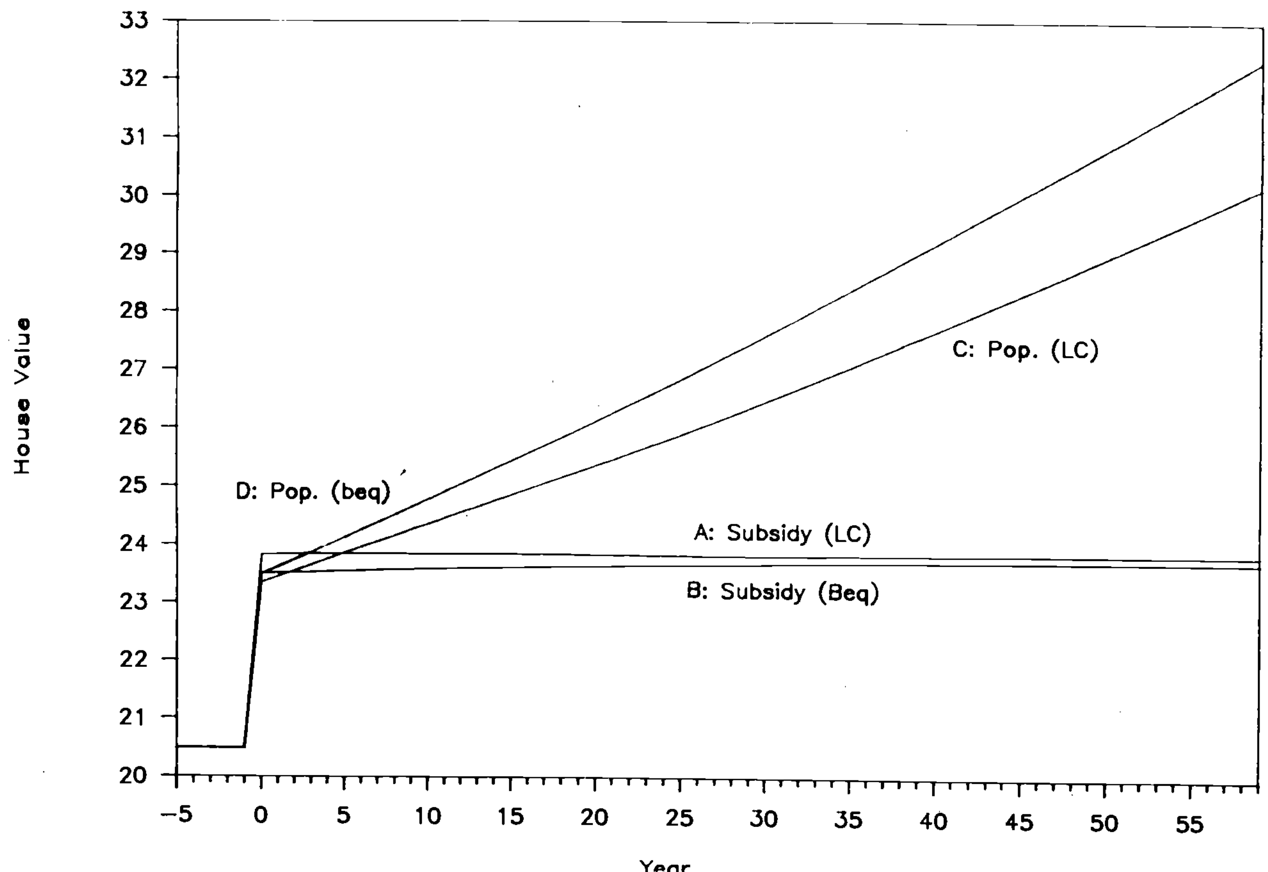

Figure 2: Aggregate Saving Rate