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Housing Wealth and the Economy's Adjustment to Unanticipated Shocks

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Abstract

This paper explores the effect of housing capital losses on the economy's response to an unanticipated negative shock using an overlapping-generations model. The model is a partial equilibrium framework where income is exogenous and mortgage funds come from outside the economy. Because of housing capital losses, the economy exhibits a volatile response to a negative income shock, with transitional rents, house prices, and consumption levels lying below the values achieved in the new steady state. The volatility of the response is shown to depend on the concentration of housing ownership.

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1. Introduction

During the recent recession, many commentators identified falling house values as a force that compounded the severity of the downturn. Falling values depressed homeowner wealth, which in turn led to reductions in consumption spending over and above those associated with current income losses due to the recession. The drop in house prices, of course, was in part caused by these same income losses, which depressed housing demand and thus pushed down rents and house values. This suggests that the effect of a cyclical downturn in incomes is amplified in the presence of owner-occupied housing. Lower incomes depress demand for both housing and non-housing goods, and the resulting drop in house values generates a capital loss for homeowners, which results in a further drop in demand for all goods.

A decline in the value of other durable assets (e.g., factories) in response to a negative shock may generate a similar wealth effect. However, the central role of residential real estate in national wealth suggests that a feedback effect operating through the housing sector may be especially important. Data cited by DiPasquale and Wheaton (1992) indicate that U.S. real estate, valued at \$8.777 trillion in 1990, accounted for 56 percent of the nation's wealth in that year. Residential real estate, representing 70 percent of total real estate value, comprised 39 percent of national wealth. In addition to this large aggregate share, real estate wealth is widely diffused, with housing equity constituting the major portion of net worth for many households. As a result, even a small percentage decline in the value of housing assets will generate wealth losses that are both large in relation to national income and widely distributed among the population.

Despite its apparent role in the recent recession, the feedback effect from changes in real estate wealth has received almost no attention in the literature on housing markets.

The purpose of the present paper is to develop and analyze a simple model that illustrates such an effect. The analysis is based on an overlapping-generations (OLG) framework where consumers live for two periods. Productive capital is absent, but a fixed stock of housing is purchased and rented out to others or used for own-consumption. To generate simple results, a key partial-equilibrium assumption is imposed. In particular, it is assumed that mortgage funds are available from outside the economy, while non-mortgage borrowing must rely on internal funds. Under these assumptions, the response to an unanticipated negative income shock is easily characterized. It is shown that the economy moves from one steady state to another via a single transition period, in which the owners of housing suffer losses. In generating these losses, the economy is shown to overshoot the final steady state. Transitional magnitudes of rent, house value, and non-housing consumption all lie below the final steady-state levels, which are in turn below those in the original steady state.¹ Overall, the lesson of the analysis is that the feedback effect from a change in housing wealth increases the volatility of the economy's response to an unanticipated shock.

Related literature includes papers by Feldstein (1977), Chamley and Wright (1987), and Ihori (1990), who analyze the effect of a land tax in general equilibrium OLG models. While Feldstein focuses on steady-state comparisons, Chamley and Wright and Ihori pay special attention to transitional effects of the kind considered in the present paper. In particular, they investigate the question of whether landowners experience capital gains or losses in response to imposition of the land tax. As seen in Chamley and Wright (1987), the answer to this question is largely ambiguous because of the complex interactions that emerge in a general-equilibrium framework. By contrast, the simple partial-equilibrium framework developed below generates clear-cut predictions about the effects of a similar unanticipated shock.

The paper is also linked to a literature that highlights housing's dual role as a consumption good and investment vehicle. This literature includes papers by Dolde (1978), Henderson and Ioannides (1983), Ranney (1981), Wheaton (1985), and Skinner (1990). As is done below, Skinner develops a partial equilibrium OLG model where housing is both a consumption good and a physical asset. In contrast to the present focus on transitional effects, Skinner carries out a steady-state analysis, exploring the effect of differential taxation

of housing and financial assets.

The next section of the paper presents the model, while the third section analyzes the impact of the income shock. The fourth section explores the effect of changes in the distribution of housing ownership, while the last section offers conclusions.

2. The Model

The basic model has overlapping generations, each of which lives for two periods. Generations are indexed by their dates of birth. Preferences are additively separable across time and are identical across generations, and utility depends on consumption of housing (h) and a numeraire non-housing good (c). Letting U denote the single-period utility function, which is assumed to be strictly concave, and δ denote the discount rate, lifetime utility for a generation born at time t is

$$U(c_0^t, h_0^t) + \frac{U(c_1^t, h_1^t)}{1 + \delta}, \quad (1)$$

where the t superscript denotes the generation and the 0 and 1 subscripts denote the first and second periods of life (the subscripts thus denote young and old). Note that (1) reflects the absence of a bequest motive.

Each individual works throughout his life, with a member of generation t earning income y_t when young and y_{t+1} when old (the subscripts here denote time periods). These incomes are fixed exogenously, reflecting the partial-equilibrium nature of the analysis. Once the model is set up, the discussion considers the impact of an unanticipated decline in income.

Although productive capital is absent, the economy has a stock of housing capital, whose services yield housing consumption. Since this stock does not depreciate, housing production can be suppressed from the model. Young members of each generation rent the housing they occupy, and each young individual also purchases a quantity of housing for use in the second period of life. A portion of this purchase is used for own consumption, while the balance is rented out to young members of the next generation. Old individuals are thus owner-occupiers as well as landlords.

Let H^t denote the quantity of housing purchased by a young member of generation t . This transaction, which occurs in period t , requires an outlay of $p_t H^t$, where p_t denotes the purchase price per unit of housing at t . This outlay is financed by a mortgage loan, and thus has no effect on consumption expenditures. Letting R_t denote housing rent in period t , the budget constraint for a young member of generation t is given by

$$y_t - c_0^t - R_t h_0^t + b^t = 0, \quad (2)$$

where b^t denotes financial borrowing (i.e., non-mortgage borrowing). Note that a negative value of b^t indicates saving.

In period $t + 1$, the old member of generation t earns rental income of $R_{t+1}(H^t - h_1^t)$, where $H^t - h_1^t$ gives the amount of owned housing not directly consumed. The individual then sells his housing assets, earning $p_{t+1} H^t$, and pays off the mortgage used in their purchase. This requires a payment of $(1 + r_{t+1})p_t H^t$, where r_{t+1} is the interest rate on borrowing in period t (payable in period $t + 1$). The budget constraint for an old member of generation t is thus

$$y_{t+1} - c_1^t - R_{t+1} h_1^t - (1 + r_{t+1})(p_t H^t + b^t) + (p_{t+1} + R_{t+1})H^t = 0. \quad (3)$$

Unless a housing-market arbitrage condition holds, the desired purchase of housing will be either infinite or zero, possibilities which are inconsistent with housing-market equilibrium. The arbitrage condition is derived by requiring that the terms multiplying H^t in (3) sum to zero, assuring that consumers are indifferent to the quantity of housing purchased. The resulting condition is

$$p_t = \frac{R_{t+1} + p_{t+1}}{1 + r_{t+1}}, \quad (4)$$

which indicates that the rate of return to housing investment, $(p_{t+1} - p_t + R_t)/p_t$, equals the return to financial investment, r_{t+1} . Substituting (4), the constraint (3) reduces to

$$y_t - c_1^t - R_{t+1} h_1^t - (1 + r_{t+1})b^t = 0. \quad (5)$$

Note that H^t is absent from (2) and (5), reflecting consumer indifference to the extent of housing ownership. Indeed, as long as the arbitrage condition holds, ownership of the housing stock plays no role in determining the economy's equilibrium. However, when an unanticipated shock leads to violation of this condition, housing ownership becomes relevant, helping to determine the transition to a new equilibrium.

The consumer maximizes (1) subject to (2) and (5), choosing optimal levels of housing and non-housing consumption as well as an optimal level of financial borrowing. This problem can be solved sequentially, with consumption levels chosen first conditional on b^t , and borrowing chosen optimally in a second stage. Let $V(R, I)$ denote the indirect utility function emerging from the single-period utility-maximization problem, with R denoting rent and I denoting income. Then, b^t is chosen in the second stage to maximize

$$V(R_t, y_t + b^t) + \frac{V(R_{t+1}, y_{t+1} - (1 + r_{t+1})b^t)}{1 + \delta}. \quad (6)$$

Equilibrium paths for rent and the interest rate are determined by market-clearing conditions for the housing and capital markets. Several key partial-equilibrium assumptions are made in order to simplify the required analysis. First, the mortgage funds used to purchase housing are assumed to come from outside the economy, supplied by investors willing to make secured loans to local borrowers. Because these outside investors cannot evaluate the credit worthiness of local borrowers, however, their funds are unavailable for unsecured loans, which must come entirely from local lenders (who have greater familiarity with their customers). Furthermore, any savings in the economy must also be deposited with local lenders because the outside investors have no demand for borrowed funds. Finally, while local lenders can make mortgage loans, it is assumed that the outside investors capture the entire local mortgage market. They do so by offering funds at an interest rate equal to the rate that prevails locally (r_{t+1} in the above discussion).² As a result, all mortgage funds come from outside the economy, with any financial borrowing and lending occurring locally. As will be seen, however, such borrowing and lending is absent in equilibrium.

Prior to the income shock, the economy is in steady-state equilibrium, with the population of successive generations constant at N and with $y_t = \bar{y}$, $R_t = \bar{R}$, $p_t = \bar{p}$, and $r_t = \bar{r}$

holding for all t . In a steady state, capital-market equilibrium requires that the conditions $(1 + r_{t+1})b^t = b^{t+1}$ and $b^t = b^{t+1}$ are satisfied for all t . These requirements indicate that generation $t + 1$'s financial borrowing is exactly balanced by the loan repayment of generation t , with successive generations also borrowing the same amounts (analogous statements apply when saving occurs). While a zero interest rate is consistent with these equilibrium conditions, as pointed out by Samuelson (1958), such an outcome is untenable in the presence of a long-lived asset such as housing because it implies an infinite price. Alternatively, the conditions can be satisfied if $b^t = 0$ holds for all t . Since income and housing rent are constant over time, this zero-borrowing outcome is optimal from the consumer's point of view only if the interest rate is equal to the discount rate, with $r_t = \delta$ holding for all t (this follows from maximization of (6)). Consumption levels are then constant over time, with $c_0^t = c_1^t = \bar{c}$ and $h_0^t = h_1^t = \bar{h}$ holding for all t .

With the interest rate determined, the purchase price per unit of housing in the steady state is $\bar{p} = \bar{R}/\delta$ using (4). Rent \bar{R} is then determined by clearing of the housing market, which requires $S = 2ND(\bar{R}, \bar{y})$, where S is the size of the housing stock and $D(R, I)$ gives individual housing demand as a function of rent and income.

3. The Impact of an Unanticipated Income Shock

Suppose that ownership of the housing stock is divided equally among the members of each generation, with $H^t = S/N \equiv \bar{H}$ holding for all t . Then, suppose that in period $t + 1$, income falls to a new permanent level $y^* < \bar{y}$. This change will affect rents, prices and interest rates in periods $t + 1$ and beyond. To analyze these effects, consider first the old members of generation t , whose budget constraint in period $t + 1$ is

$$y^* - c_1^t - R_{t+1}h_1^t - (1 + \delta)\bar{p}\bar{H} + (p_{t+1} + R_{t+1})\bar{H} = 0. \quad (7)$$

(recall $b^t = 0$ and that mortgage repayment requires an outlay of $(1 + \delta)\bar{p}\bar{H}$). Since (4) implies $(1 + \delta)\bar{p}\bar{H} = \bar{p} + \bar{R}$, (7) can be rewritten as

$$y^* - c_1^t - R_{t+1}h_1^t + (p_{t+1} - \bar{p} + R_{t+1} - \bar{R})S/N = 0. \quad (8)$$

The term $(p_{t+1} - \bar{p})S/N$ in (8) equals the unanticipated change in the value of generation t 's housing while the term $(R_{t+1} - \bar{R})S/N$ is the unanticipated change in rental income. It is shown below that the sum of these terms is negative and that the terms are individually negative under a plausible assumption. For simplicity, the sum is assumed to be smaller in absolute value than y^* , so that the consumer's net income is positive. In its remaining period of life, generation t chooses c_1^t and h_1^t to maximize $U(c_1^t, h_1^t)$ subject to (8). The values of R_{t+1} and p_{t+1} are then determined by appropriate market-clearing conditions.

To derive these conditions, the first step is to consider the capital market, focusing on the financial borrowing and lending decision of generation $t + 1$, newly arrived following the shock. First, observe that because financial borrowing or lending was absent in the pre-shock equilibrium, generation t is neither making bank deposits in period $t + 1$ to pay off a consumption loan nor withdrawing bank funds in period $t + 1$ to recover the proceeds of saving. As a result, the option of financial borrowing or lending is closed for generation $t + 1$ because there is no offsetting demand or supply of local funds from generation t . Recall that outside funds, which are available for mortgage loans, cannot be used to support financial borrowing, and that there is no outside demand for the savings of the local economy's residents. Therefore, capital-market equilibrium in period $t + 1$ requires an interest rate r_{t+2} that yields zero demand for financial borrowing by generation $t + 1$.

Before formally developing this condition, several of its implications are considered. The key observation is that in the absence of borrowing or lending in period $t + 1$, disposable income for all consumers alive in period $t + 2$ and beyond is constant and equal to y^* . As a result, the equilibrium path from $t + 2$ onward consists of a new steady state corresponding to the lower income level y^* .

Letting the rent level and housing purchase price in this steady state be denoted R^* and p^* , period $t + 1$'s housing purchase price can be written

$$p_{t+1} = \frac{R^* + p^*}{1 + r_{t+2}} = \frac{(1 + \delta)R^*}{\delta(1 + r_{t+2})}, \quad (9)$$

using $p^* = R^*/\delta$. Then, using (9) and $\bar{p} = \bar{R}/\delta$, the term $y^* + (p_{t+1} - \bar{p} + R_{t+1} - \bar{R})S/N$ in

(8), which gives post-shock income for the old members of generation t , becomes

$$y^* + \left[R_{t+1} + \frac{1+\delta}{\delta} \left(\frac{R^*}{1+r_{t+2}} - \bar{R} \right) \right] \frac{S}{N}. \quad (10)$$

Given (10), the condition for housing-market equilibrium in period $t+1$ can be stated. Equilibrium requires that the housing demands of generations t and $t+1$ add up to the available stock S . The equilibrium condition is thus

$$ND(R_{t+1}, y^*) + ND \left(R_{t+1}, y^* + \left[R_{t+1} + \frac{1+\delta}{\delta} \left(\frac{R^*}{1+r_{t+2}} - \bar{R} \right) \right] \frac{S}{N} \right) = S. \quad (11)$$

Note that R_{t+1} appears in (11) both as the price term in the demand functions and as a component of income for generation t . The income of the newly-arrived generation $t+1$ is, by contrast, exogenous and equal to y^* .

Eq. (11) implicitly defines a locus of (r_{t+2}, R_{t+1}) points consistent with clearing of the housing market. To investigate the slope of this locus, let D_R and D_I denote the partial derivatives of the demand function $D(R, I)$. Housing is assumed to be a normal good, so that $D_I > 0$ and $D_R < 0$. Then, affix t and $t+1$ superscripts to these derivatives to denote the old and young individuals, whose income arguments differ. Differentiation of (11) with respect to R_{t+1} then yields

$$\begin{aligned} N(D_R^t + D_R^{t+1}) + SD_I^t &= N(D_R^t|_{u=const} + D_R^{t+1}|_{u=const}) + SD_I^t - Nh_1^t D_I^t - Nh_0^{t+1} D_I^{t+1} \\ &= N(D_R^t|_{u=const} + D_R^{t+1}|_{u=const}) + Nh_0^{t+1} (D_I^t - D_I^{t+1}) \\ &\equiv \Omega. \end{aligned} \quad (12)$$

The first equality in (12) makes use of the Slutsky equation, while the second uses the condition $N(h_1^t + h_0^{t+1}) = S$. Ω is clearly negative when demand is linear in income, in which case $D_{II} = 0$ and the last term in (12) vanishes, leaving only the negative income-compensated price derivatives. Because a positive sign for Ω cannot be ruled out otherwise, however, this possibility is excluded by assuming that the equilibrium is Hicksian stable,

which requires excess demands for all goods to be decreasing in own-prices. This assumption implies that R_{t+1} 's effect on demand through the price term in (11) dominates the effect operating through the income term. Using $\Omega < 0$ and differentiating (11) with respect to r_{t+2} , the slope of the housing-market equilibrium locus is then

$$\frac{\partial R_{t+1}}{\partial r_{t+2}} = \frac{SD'_I(1+\delta)R^*}{\delta(1+r_{t+2})^2\Omega} < 0. \quad (13)$$

To interpret (13), observe that because an increase in R_{t+1} leads to lower housing demand ($\Omega < 0$), an offsetting decline in r_{t+2} is required to keep demand constant. This decline raises the present value of future rents, reducing generation t 's capital loss and thus raising its income.

The condition for capital-market equilibrium, which was mentioned above, can now be formalized. Generation $t+1$'s problem is to maximize utility subject to constraints analogous to (2) and (5), where second period rent is equal to the steady-state level R^* . Using the indirect utility function $V(R, I)$ from above, generation $t+1$'s problem is to choose financial borrowing, denoted b^{t+1} , to maximize

$$V(R_{t+1}, y^* + b^{t+1}) + \frac{V(R^*, y^* - (1+r_{t+2})b^{t+1})}{1+\delta}. \quad (14)$$

Since capital-market equilibrium requires that the solution to this problem yield zero borrowing, the first-order condition must be satisfied at $b^{t+1} = 0$, which requires

$$\frac{V_I(R_{t+1}, y^*)}{1+r_{t+2}} = \frac{V_I(R^*, y^*)}{1+\delta}, \quad (15)$$

where the subscripts denote partial derivatives. Note that the second-order condition for this problem is satisfied given $V_{II} < 0$, which follows from strict concavity of the direct utility function U .

Eq. (15) implicitly defines a locus of (r_{t+2}, R_{t+1}) points consistent with clearing of the capital market. The slope of this locus is found by totally differentiating (15), which yields

$$\frac{\partial R_{t+1}}{\partial r_{t+2}} = \frac{V_I}{(1+r_{t+2})V_{RI}} \quad (16)$$

(the V derivatives are evaluated at (R_{t+1}, y^*)). To evaluate the key term V_{RI} in (16), the relationship $V_R = -V_I h$ from Roy's identity is differentiated to yield

$$V_{RI} = -V_{II}h - V_I \frac{\partial h}{\partial I}, \quad (17)$$

an expression that is ambiguous in sign when housing is a normal good. Intuitively, while an increase in I reduces the marginal utility of income, which lowers $-V_I h$ in absolute value, the higher I also raises h , which has the reverse effect. In the Cobb-Douglas case, the latter effect dominates, yielding $V_{RI} < 0$ and implying that the capital-market locus is downward-sloping.³

To see why the locus slopes down when $V_{RI} < 0$, observe that a higher R_{t+1} lowers the payoff from an extra dollar spent in period $t + 1$, decreasing the incentive to borrow. This requires an offsetting decline in the interest rate, which increases the incentive to borrow and maintains the zero-borrowing equilibrium.⁴

Equilibrium values of R_{t+1} and r_{t+2} , which are determined by simultaneous clearing of the housing and capital markets, must satisfy (11) and (15). The solution is illustrated in Figures 1 and 2, where the equilibrium corresponds to the intersection of housing-market and capital-market loci in (r_{t+2}, R_{t+1}) space. Figure 1, where the capital-market locus slopes down ($V_{RI} < 0$), is drawn to reflect Hicksian stability of the equilibrium, which requires that the capital-market locus be steeper than the housing-market locus at the intersection.⁵ Figure 2 illustrates the case where $V_{RI} > 0$ and the capital-market locus slopes up (stability is then automatic). The case where $V_{RI} = 0$, which has a vertical capital-market locus, is not illustrated.

It is now possible to address the main questions of interest: Do homeowners indeed suffer losses as a result of the income shock? How do the transitional values of the price variables in the model compare to the final steady-state values? The answer to these questions is as follows:

Proposition 1. *If $V_{RI} \leq 0$, the unanticipated negative income shock leads to rental income losses and capital losses for owners of housing. In generating these losses, both housing rent and the housing price overshoot their final steady-state values,*

with $R_{t+1} < R^* < \bar{R}$ and $p_{t+1} < p^* < \bar{p}$. The interest rate r_{t+2} temporarily rises above the discount rate δ if $V_{RI} < 0$, while $r_{t+2} = \delta$ holds if $V_{RI} = 0$. When $V_{RI} > 0$, rent overshooting still occurs and $r_{t+2} < \delta$. While housing owners still experience a net loss, the change in the housing purchase price is ambiguous.

Proof: To establish these results, consider first the changes in rent and the interest rate. Suppose that $R_{t+1} = R^*$ were satisfied, which implies $r_{t+2} = \delta$ from (15). Substituting these values in (11), the income term for generation t reduces to $y^* + (R^* - \bar{R})(1 + \delta)/\delta < y^*$, where the inequality follows because \bar{R} is the steady-state rent corresponding to the higher income level \bar{y} (implying $R^* < \bar{R}$). This inequality, together with the fact that R^* satisfies $2ND(R^*, y^*) = S$, means that the left-hand side of (11) is less than S when evaluated at $(r_{t+2}, R_{t+1}) = (\delta, R^*)$. This implies that the point (δ, R^*) , which lies on the capital-market locus, yields excess supply in the housing market. Given that housing demand is decreasing in R_{t+1} , such a point must lie *above the housing-market locus*. In the case where $V_{RI} \leq 0$, shown in Figure 1, the equilibrium point must then have $R_{t+1} < R^*$ and $r_{t+2} \geq \delta$. If $V_{RI} > 0$, the equilibrium point again has $R_{t+1} < R^*$, but $r_{t+2} < \delta$ holds, as shown in Figure 2. When $V_{RI} < 0$, (9) along with $r_{t+2} \geq \delta$ yield $p_{t+1} < p^* = R^*/\delta < \bar{p}$. The first inequality implies that the housing price overshoots its steady-state value, while the inequalities together establish that that housing owners suffer capital losses. By contrast, since $r_{t+2} < \delta$ holds when $V_{RI} > 0$, $p_{t+1} > p^*$ holds and the relation between p_{t+1} and \bar{p} is ambiguous. Thus, while housing capital gains may occur, it can be shown that these must be offset by lower rental income, so that housing owners experience a net loss.⁶ \diamond

The impact of the shock on consumption levels can also be investigated. It is easily seen that transitional housing consumption levels satisfy $h_0^{t+1} > h^* > h_1^t$. The first inequality, which says that generation $t+1$'s transitional consumption lies above the steady-state value, follows because $R_{t+1} < R^*$ and transitional income is the same as in the new steady state. The second inequality, which says that generation t 's consumption lies below the steady-state level, follows because the stock of housing is fixed (a fact that also yields $h^* = \bar{h}$).

Unambiguous conclusions regarding transitional non-housing consumption are not possible because the transitional price of the other good (housing) lies below the new steady-state level, creating opposing income and substitution effects. In the Cobb-Douglas case, how-

ever, non-housing consumption is independent of rent, and transitional consumption equals the new steady-state level for generation $t + 1$ and lies below it for generation t , so that $c_0^{t+1} = c^* > c_1^t$. In this case, total non-housing consumption $N(c_0^{t+1} + c_1^t)$ overshoots the steady state value of Nc^* .

The above discussion shows that in the Cobb-Douglas case, which satisfies $V_{RI} < 0$, the adjustment of rents, house values, and total non-housing consumption is characterized by overshooting of the final steady state. Figure 3 summarizes this pattern, highlighting the volatility of the economy's response to the unanticipated shock. If the economy were somehow insulated from the effect of housing losses, which account for the pattern in Figure 3, adjustment to the shock would occur immediately without overshooting. Suppose for example, that housing were owned by absentee landlords who live outside the economy. All consumers would then be renters, and while the budget constraints (2) and (5) would remain relevant, the loss term would disappear from (10) and (11). The new steady state would then be achieved in period $t + 1$ with no intervening transition period.

4. The Effect of Changes in the Distribution of Housing Ownership

The volatility of the adjustment process is affected by the distribution of housing ownership in the economy. While equal ownership was assumed above, suppose instead that a fraction α of each generation owns no housing. Housing ownership is concentrated in the remaining $1 - \alpha$ of the generation's members. Recall that since individuals are indifferent to the extent of ownership in the steady state, any distribution whatever is admissible in equilibrium.

The αN individuals of generation t who own no housing experience no losses in response to the income shock. As a result, they are indistinguishable from the newly-arrived members of generation $t + 1$, with consumption for both groups based on an income level of y^* . As a result, the demand condition (11) can be rewritten as

$$(1 + \alpha)ND(R_{t+1}, y^*) + (1 - \alpha)ND\left(R_{t+1}, y^* + \left[R_{t+1} + \frac{1 + \delta}{\delta} \left(\frac{R^*}{1 + r_{t+2}} - \bar{R}\right)\right] \frac{S}{(1 - \alpha)N}\right) = S. \quad (18)$$

Observe in (18) that each of the $(1 - \alpha)N$ housing owners incurs losses on $S/(1 - \alpha)N$ worth of housing.

This modification has no effect on the steady-state equilibria nor on the qualitative results summarized in Proposition 1. In other words, overshooting as described in the proposition occurs regardless of the magnitude of α . However, a change in the distribution of ownership may affect the volatility of the adjustment to the new steady state, as follows:

Proposition 2. *If $D_{II} < 0$, an increase in the concentration of housing ownership (a higher α) heightens the volatility of the economy's response to the unanticipated income shock. R_{t+1} lies farther below its steady-state value (implying greater rent overshooting) the larger is α , and the increase in α drives r_{t+2} farther above δ when $V_{RI} < 0$ (farther below δ when $V_{RI} > 0$). If $D_{II} > 0$, then the reverse conclusions hold, with an increase in α lessening the volatility of the response to the income shock. If $D_{II} = 0$, then the response to the shock is unaffected by the magnitude of α .*

Proof: Differentiating the left-hand side of (18) with respect to α yields N times the expression

$$D(R_{t+1}, y^*) - D\left(R_{t+1}, y^* - \frac{LS}{(1 - \alpha)N}\right) - \frac{LS}{(1 - \alpha)N} D_I\left(R_{t+1}, y^* - \frac{LS}{(1 - \alpha)N}\right), \quad (19)$$

where L equals the absolute value of the loss per unit of housing (the bracketed term inside the second demand function in (18)). To sign (19), observe that the second and third terms represent a first-order Taylor series approximation of $D(R_{t+1}, y^*)$, where the reference point is $y^* - LS/(1 - \alpha)N < y^*$. If D is strictly concave in I ($D_{II} < 0$), this approximation is greater than $D(R_{t+1}, y^*)$ itself. As a result, (19) is negative, indicating that housing demand decreases as α rises (as ownership becomes more concentrated). A decline in R_{t+1} is therefore required to keep demand constant as α rises, implying that the housing-market locus shifts down. Inspection of Figures 1 and 2 then yields the first part of the Proposition. If instead $D_{II} > 0$, then (19) is positive, the housing-market locus shifts up as α rises, and the second part of the Proposition follows. If $D_{II} = 0$, then (19) is zero, and the Proposition's third part follows. \diamond

To see the intuition underlying Proposition 2, observe that an increase in α raises the magnitude of losses for each owner of housing while shrinking the number of owners. When demand is a concave function of income ($D_{II} < 0$), the fact that individual losses are greater dominates the shrinkage in the number of losers, leading to a decline in housing demand for given (R_{t+1}, r_{t+2}) and thus to stronger overshooting. When demand is instead convex ($D_{II} > 0$), the latter effect dominates, leading to weaker overshooting, and when demand is linear, the effects exactly offset one another, so that overshooting is insensitive to the magnitude of α .

Note that while the third case applies with Cobb-Douglas preferences, strictly concave demand is likely to be the most realistic assumption. To see this, observe that if the natural restriction $D(R, 0) = 0$ holds, so that the demand function passes through the income origin, the only way the income elasticity of housing demand $D_I I / D$ can be less than one, in conformance with empirical evidence, is for D_{II} to be negative. This conclusion, which assumes that D_{II} is either positive, zero, or negative for all values of I , never changing sign, is easily seen from a diagram. In this realistic case, Proposition 2 implies that increased concentration of ownership heightens the volatility of the economy's response to the income shock. This effect is shown by the dotted curve in Figure 3.

Ownership redistribution might have a different effect in a model with multiple income groups. Suppose that in such a model, housing losses were shifted toward lower-income individuals, reflecting a more-egalitarian distribution of housing ownership. Then, if $D_{II} < 0$ holds, implying that demand is more income sensitive for lower-income consumers, the more-egalitarian incidence of losses would depress total housing demand, shifting the housing-market locus down. This would appear to heighten the volatility of the response to the shock, in contrast to the results of Proposition 2. Unfortunately, proper analysis of this issue is more involved than that carried out so far. The reason is that the conditions of capital-market equilibrium are different in a multi-group model. In particular, (15) cannot, in general, hold simultaneously for several income groups, implying that the zero-borrowing feature of the transitional equilibrium disappears. This means that the new steady state is not reached in period $t + 2$, but that a long adjustment process unfolds instead.

5. Conclusion

This paper has provided a simple partial-equilibrium analysis of the effect of housing wealth on the economy's adjustment to unanticipated shocks. The analysis has shown that housing losses increase the volatility of the response to a negative income shock, with rents, house values, and total consumption dropping below their final steady-state levels as the economy adjusts. This finding illustrates the common assertion that wealth losses may exacerbate the impact of income fluctuations associated with the business cycle.

The model's tractability is due to the key assumption that mortgage funds come from outside the economy. To relax this partial-equilibrium assumption, moving to a full general-equilibrium framework, the model would be modified in a number of ways. First, consumers would work only when young, requiring accumulation of savings for consumption in old age. Savings would be used to acquire housing, which would be rented out and then resold as before, and to purchase productive capital, which would be added to the model. The size of the capital stock, and hence workers' wages, would be endogenous, and the analysis could focus on the effect of a negative productivity shock (analogous to the above income shock). A key difference between this framework and that analyzed above is that internal funds, rather than external mortgage money, would be used to purchase housing. The rationale for such a purchase, absent above, would be saving for old age. Development of such a framework is left for future work.

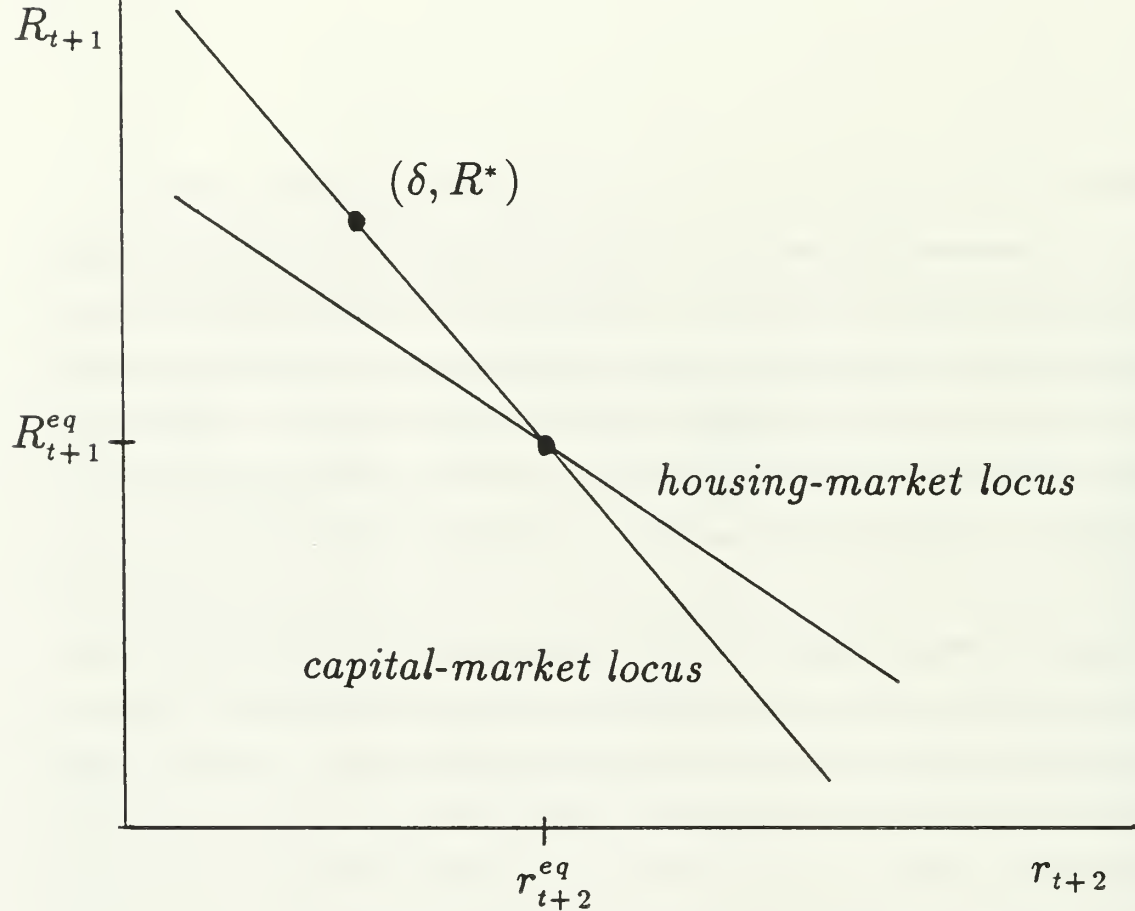


Figure 1: Equilibrium with $V_{RI} \leq 0$

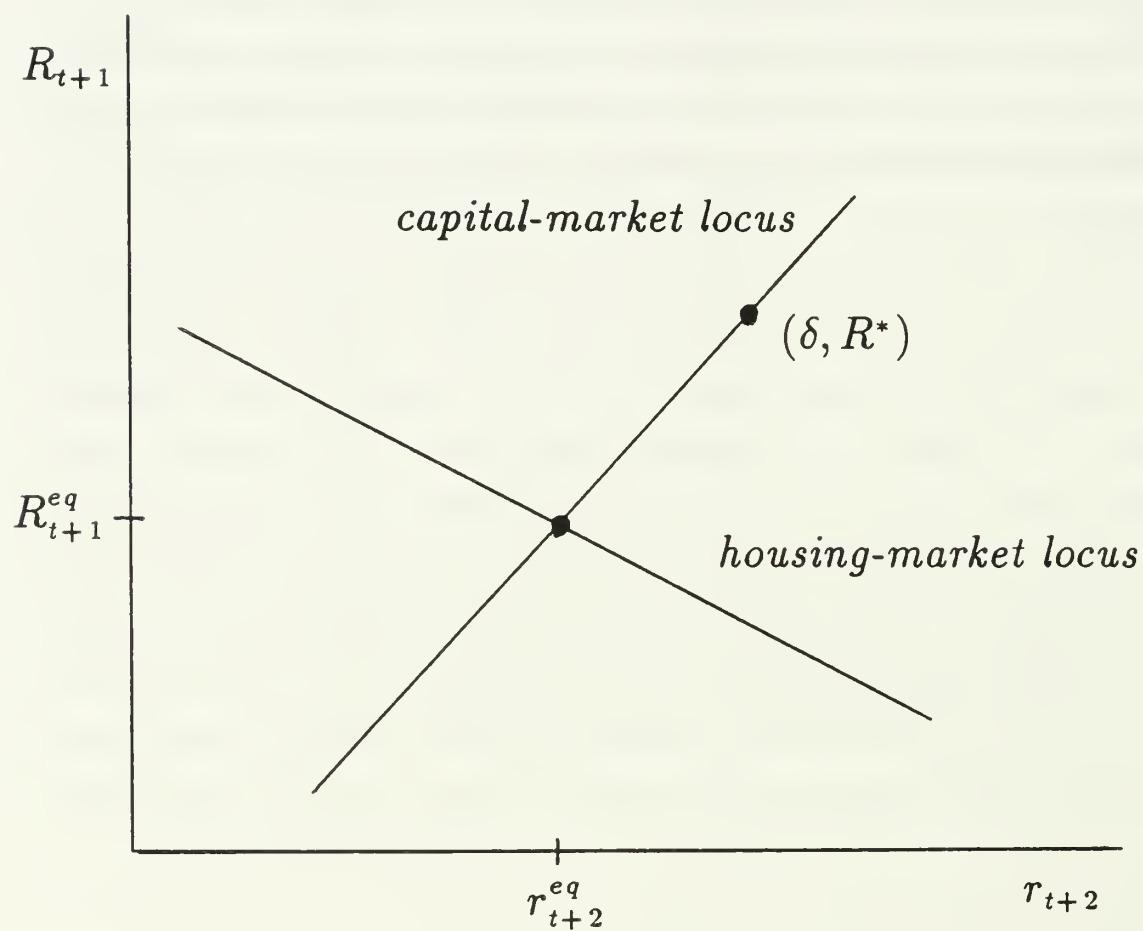


Figure 2: Equilibrium with $V_{RI} > 0$

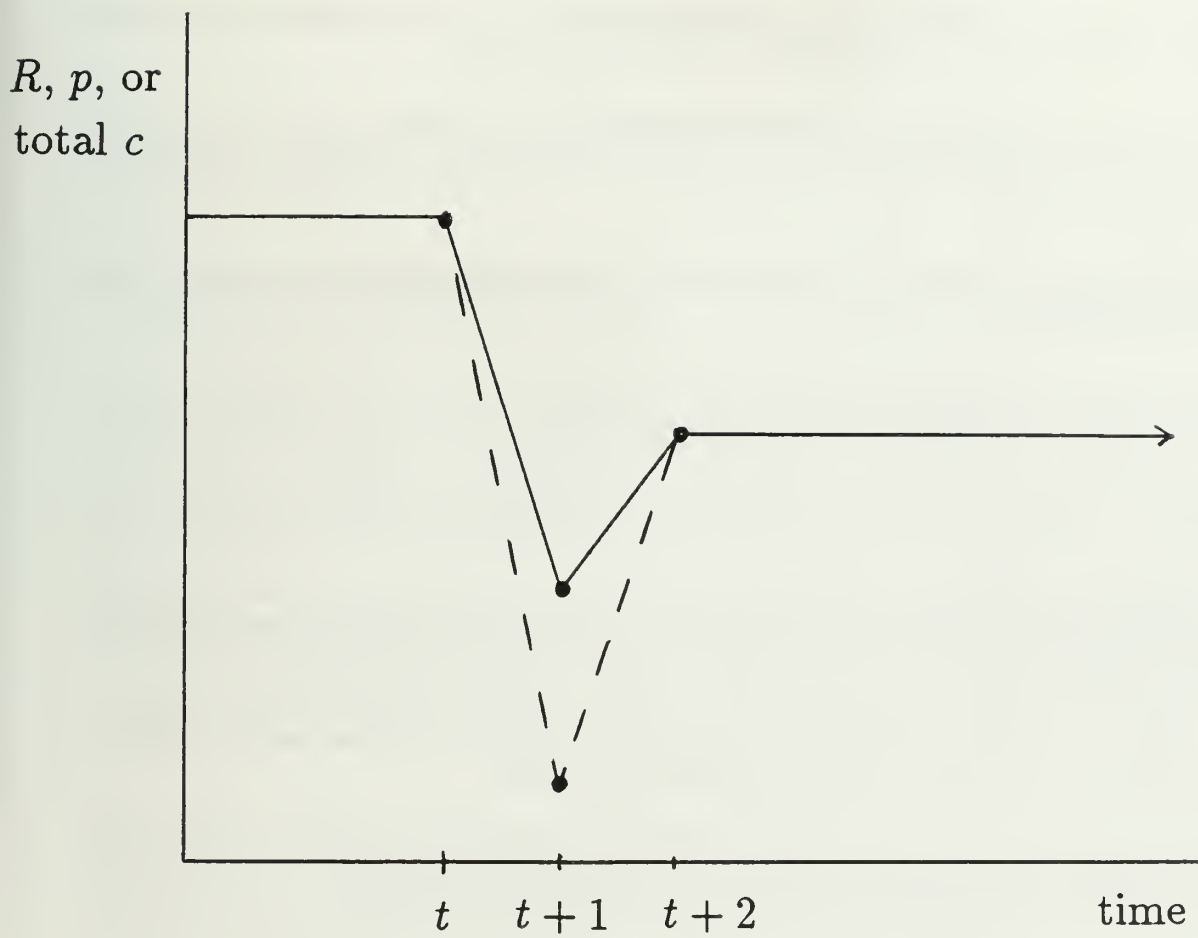


Figure 3: Volatility of the Adjustment Process

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Footnotes

¹This statement holds with certain qualifications discussed below.

²Observe that this assumption implies non-competitive behavior on the part of outside investors. With competitive behavior, mortgage funds would be available at the investors' reservation price.

³Note that for $V_{II} < 0$ to hold in the Cobb-Douglas case, the degree of homogeneity of the utility function must be less than one.

⁴This statement reflects the fact that an decrease in the interest rate always leads to greater borrowing starting from an initial borrowing level of zero (the income effect that makes the impact generally ambiguous is then absent).

⁵Hicksian stability requires that when the interest rate is adjusted to clear the capital market, excess housing demand is positive (negative) as R_{t+1} is below (above) the equilibrium (see Quirk and Saposnik (1968)). This condition is satisfied in both Figures but does not hold when the capital-market locus is downward-sloping and flatter than the housing-market locus.

⁶To see this, suppose the contrary, namely that the equilibrium involves gains for owners of housing. This implies that generation t 's income lies above y^* at the equilibrium point in Figure 2 while lying below y^* at the point (δ, R^*) on the capital-market locus, as demonstrated above. For this to be true, income must exactly equal y^* at some intermediate point on the locus. But at such a point, both income terms in (12) equal y^* while R_{t+1} lies below R^* , implying excess demand in the housing market. Because the point in question lies above the housing-market locus, this conclusion yields a contradiction.

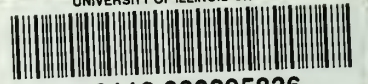
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