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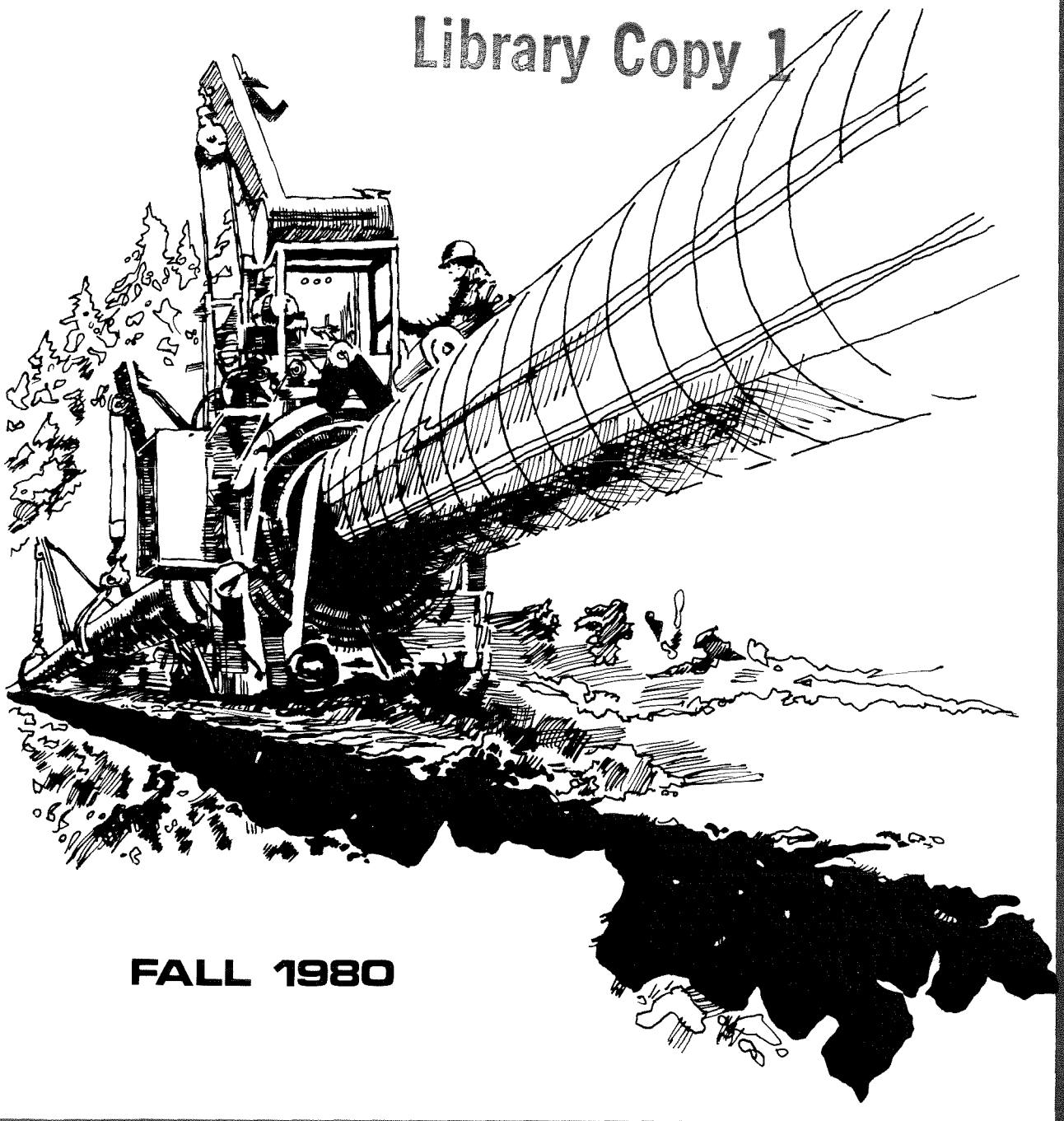

FALL 1980

RESOURCE ALLOCATION - INDUSTRY AND HOUSING

Inflation Expectations and the Housing Market

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There is a growing consensus that inflation is not an entirely "neutral" process. Institutional features of the economy, such as tax and credit-market policies, can interact with inflation to affect relative prices, leading to disturbances in the levels of real activity in various sectors of the economy.[1] Nowhere is this phenomenon more evident than in the housing market. Significant changes in the relative price of housing have accompanied the general inflation of the last decade and a half. These events have also prompted changes in the level of housing consumption and patterns of housing tenure.

This article presents a simple model of the housing market and examines the behavior of the market during a period of rising inflation expectations. The demand for housing is viewed as the demand for an asset stock in a household or landlord's portfolio. This approach distinguishes between the "price" and user "cost" of housing, and emphasizes the role of expectations in determining housing demand. We describe how inflation expectations and other economic variables can produce observed changes in housing prices, rents, and tenure patterns.

The results of the analysis have a number of implications for housing policy and for the regulation of home-mortgage credit. In particular, we find little evidence that, in the aggregate, a "crisis" exists in the price or supply of housing, or that "affordability" has been a serious constraint. Moreover, we argue that the often-lamented decline in the rental market—with the related rise in conversions of apartments to condominiums—can be seen simply as a symptom of the market's adjustment to inflation pressures. Finally, the discussion puts into focus the current debate about the appropriate methodology for incorporating housing costs in the most commonly used index of prices, the Consumer Price Index (CPI).

The first section of this paper describes the trends in the housing market that have developed during the recent inflation. The second section presents a highly simplified view of the housing market, and explores the processes that determine housing prices, rents, and the balance between rental and owner-occupant modes of housing tenure. A third section provides some elaborations of the simple model, including its consistency with rational expectations and the effects of imperfections in the credit market. The fourth section presents empirical support for the thesis developed in this paper, and the final section discusses the policy implications of the paper's conclusions.

I. Recent Trends in Housing

The housing market has changed dramatically during the last decade, as seen most notably in the rapid increase in housing prices relative to most other prices in the economy. Between 1970 and 1980, the price of a single-family home[2] of a given quality increased at about a 9.3-percent annual rate, compared with a 6.8-percent annual rise in overall consumer prices (measured by the personal-consumption expenditures deflator). This increase in real housing prices (Chart 1), coupled with

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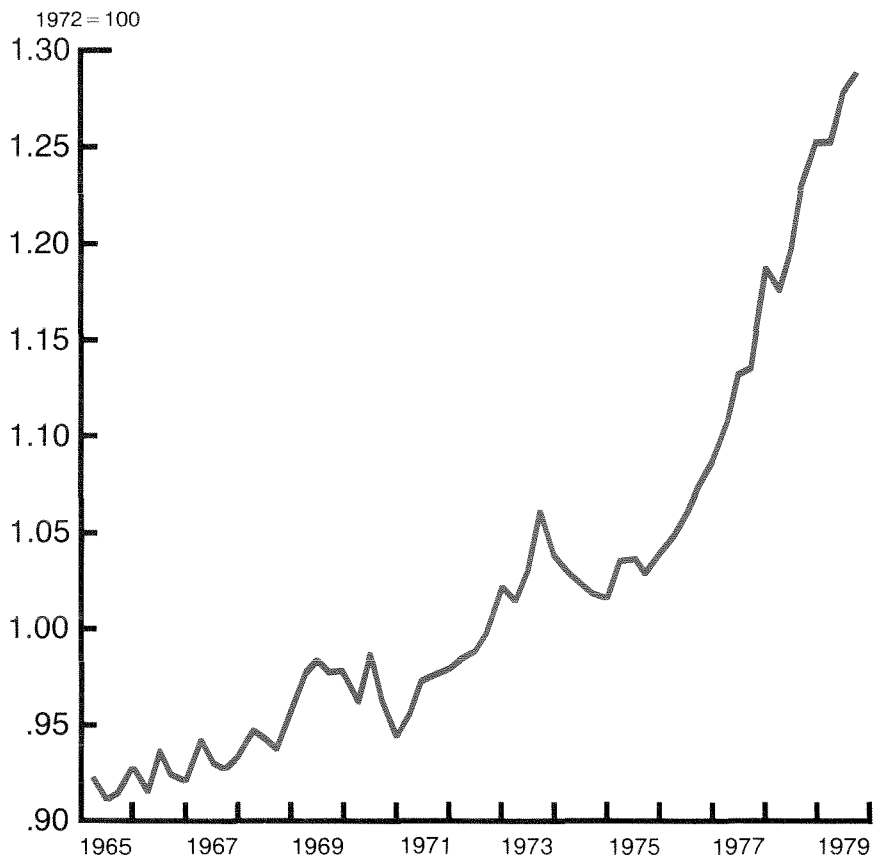
rising mortgage rates, has prompted officials to argue that housing had become "unaffordable." Yet, the consumption of housing services, by any measure, has apparently continued to rise. The simple number of housing units has grown faster than the population (Chart 2), while the quality of housing services has risen as well. The average new home in 1979 had a greater floor area, more bathrooms and bedrooms, and more amenities (such as garage space and central air conditioning) than a new home in 1970.[3]

Another major recent phenomenon has been the decline of the rental housing market. The earlier steep decline in the rental share of the housing market had slowed in the 1960s, but then accelerated again in the last decade. In 1970, 37 percent of all American families depended upon rental housing for their housing needs, but by 1980 the figure may have dropped to as low as 33 percent. Such a decline in the rental share would be four times greater than the percentage decline registered in the previous decade.[4]

As one of the manifestations of this trend, many young households, traditionally renters, have become owner-occupants. In 1970, only about 39 percent of household heads under the age of 30 were owner-occupants; by 1975 that proportion had increased to over 46 percent.[5] Although homeownership has broadened to include some relatively low-income young families, the very poorest families remain in rental housing. Renters on average earned 64 percent of the national median income in 1970, but only 55 percent in 1977.

Chart 1

Index of Real Housing Prices



In contrast to the trends in housing prices, housing *rents* have generally fallen relative to general consumer prices. Between 1970 and 1980, real rents declined approximately 10 percent (Chart 3). Combined, the trends in prices and rents have reduced the attractiveness of rental-property investment for many investors, despite the prospect of capital gains. The often-heard lament is that investment in rental housing does not "pencil out."[6]

In terms of the housing stock itself, the shift away from rental housing has taken two forms. First, the rate of construction of rental property has dropped significantly despite large Federal subsidies. In 1979, a generally average year for housing, total rental-unit construction (subsidized and unsubsidized) declined almost 20 percent from a year earlier. The 210,000 unsubsidized units started in 1979 was the lowest number in 20 years, and less than half the historic peak, and the number started in 1980 may have dropped as low as 120,000 units.[7]

Second, many existing multi-unit properties have been converted to condominiums. In 1979, 195,000 rental units were converted—up 70 percent in a single year. A more subtle form of conversion, however, has also occurred with a decline in the proportion of rented single-family homes. In 1970, 19.3 percent of single-family homes were occupied by renters; by 1976, this figure had fallen to 16.6 percent.[8]

Some policymakers see these trends as creating a dual "crisis" in housing. On the one hand, they fear that rising housing prices and mortgage rates are rapidly making owner-occupied housing "unaffordable."[9] On the other hand, they fear that the shrinking rate of new rental housing construction and the conversion of existing rental properties to condominiums are choking off the rental alternative. Policymakers have developed many responses to this perceived crisis, including expansion of governmental responsibility in the housing area. Indeed, in 1979, an estimated 75 percent of multifamily starts were Federally subsidized or insured, and governmental mortgage-assistance programs have proliferated, particularly at the local level. It is important, therefore, to understand clearly the genesis of the trends which have stimulated this policy response.

Chart 2

Occupied Housing Units Per Capita

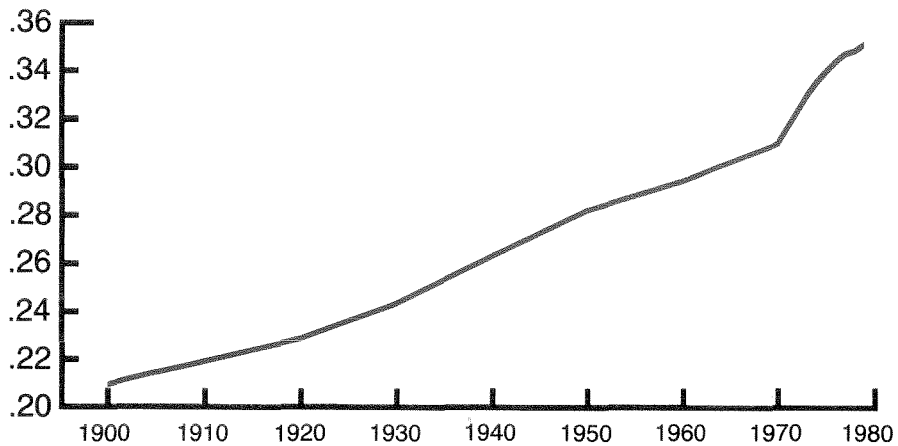
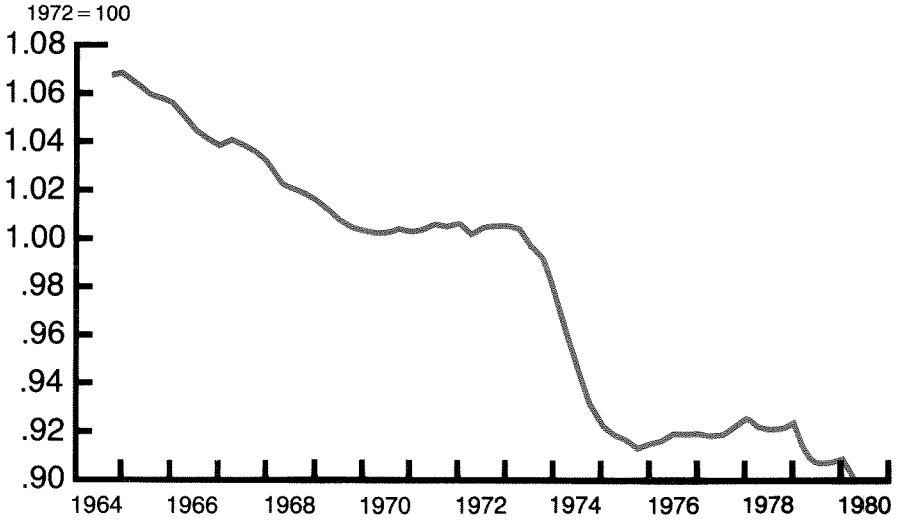


Chart 3

Index of Real Rental Costs



II. Modelling the Housing Market

In this section we employ a demand-and-supply model of the housing market to demonstrate how the economic environment of recent years has produced the changes noted above in housing prices, rents, and tenure patterns. The model first analyzes owner-occupied housing and then expands to incorporate the rental market as well. The discussion focuses on the market for the housing *stock,* but it also has implications for the market for housing *services,* because housing services flow in rough proportion to the stock.

To simplify matters, we assume that the housing stock can be meaningfully measured in quality-adjusted units. Thus an increase in the stock can be interpreted as either an increase in the number of structures, an increase in their quality (that is, their ability to produce housing services), or both.

Housing demand

The first step in devising our model is the specification of the demand for the housing stock. Many housing studies have treated the demand for the housing stock analogously to the demand for consumption goods, where the purchase price and the consumer's income are the relevant arguments of demand.[10] However, the housing stock is not a consumption good *per se,* but rather an asset that can be employed by owner-occupants to *produce* for themselves a flow of consumption services (shelter, privacy, access to community services, etc.) many periods into the future.

Viewed from this perspective, a consumer's decision on housing-stock ownership thus has features of both a consumption decision and an investment/production decision. This has several implications for the proper specification of the demand relationship. First, since a household uses housing over a period of time, the "price" variable relevant to today's housing demand is the expected *cost* of this use, relative to other prices, for each period over the planning horizon—not simply the purchase price of the asset itself. Obvious cost flows associated with homeownership include the foregone interest earnings on the equity in the house, the interest cost of borrowed funds, depreciation, maintenance, insurance, property taxes and real-estate transaction costs. In addition, however, the "investment" aspects of homeown-

ership offer the prospect of capital gains or losses over the holding period; thus user costs are reduced by any expected increase in the value of the house.

Second, a household's consumption of goods and services—including housing services—apparently changes proportionally with the household's wealth or permanent income. Since housing services flow in proportion to the stock, stock demand thus should depend upon the household's real wealth—primarily, of course, the present value of expected future real income—as perceived by the household at the time it does its planning.

We can thus write the demand for housing assets more precisely as

$$D_o^* = f(U_n/P_c, W)$$

where U_n is the nominal user cost of housing capital (assumed for simplicity to be the same for each period in the planning horizon), P_c is the price of consumption goods each period, and W is a measure of real wealth.[11] The desired stock, D_o^*, is positively related to the scale variable, W, and negatively related to relative "prices," U_n/P_c, as in traditional consumer theory.

On the assumption that there are no income taxes and that depreciation, maintenance and property taxes can be ignored, the nominal user cost can be approximated by

$$U_n = iP_n - \dot{P}_e.$$

where i is the nominal interest rate on long-term investments, P_n is the nominal price of housing, and $\dot{P}_e$ is the expected nominal increase in home values. The first term in this equation is the interest cost of housing (that is, the sum of foregone interest on equity and borrowing cost) and the second term is the expected capital gain.

Income-tax law potentially affects this simple measure of an owner-occupant's user capital cost in a number of ways. First, interest income is taxable and interest payments are deductible from taxable income. Thus the interest rate should be expressed in after-tax terms. Second, U.S. tax laws potentially affect the capital-gains term in the user-cost formula. However, the exemptions from capital gains taxes are so liberal that, for practical purposes, the homeowner can anticipate receiving the gross capital gain.

Another important implication is the influence of inflation expectations on the nominal interest rate. In particular, if lenders expect prices to rise over an extended period into the future, they will require higher long-term interest charges in order to compensate for the expected loss in purchasing power. Empirical studies indicate that the relationship is a simple one: the nominal interest rate is the sum of the real interest rate and the expected rate of inflation.

Taking these tax features into account, and incorporating the assumption that the nominal interest rate is the sum of the real interest rate, r, and the expected rate of general price inflation, z, we may restate the nominal user cost as

$$\begin{aligned} U_n &= P_n((r+z)(1-t) - (\dot{P}_e/P_n)) \\ &= P_n((r+z)(1-t) - h) \end{aligned}$$

where h is the expected rate of inflation in housing prices and t is the household's marginal tax rate. Finally, dividing by P_c, the price of consumption goods, we obtain

$$U = P((r+z)(1-t) - h)$$

where $U = U_n/P_c$ is the real user cost relevant to the housing-demand relationship and $P = P_n/P_c$ is the real price of housing.

The conceptualization of housing demand as the demand for a durable good offers a number of insights which are often overlooked in analyses of the housing market. First, the factor which acts like a "price" variable in the demand relationship is not simply the current price of housing, but the *expected* cost to the owner of the housing asset per period. Unlike the typical consumption-good price, therefore, the analogous housing variable is inherently more difficult to observe because of its prospective nature.

Second, inflation expectations and taxes play an important role in determining user costs and, hence, housing demand. For example, if households expect housing prices to increase at the same rate as other prices in general (that is, z = h), then an increase in those expectations should cause real user costs to *fall* and, hence, housing demand to *rise.* The potency of the effect, however, is dependent upon the tax rate. If the tax rate is zero, real user costs will be insensitive to inflation expectations. (Of course, if housing inflation expectations differ from general inflation expectations, user costs would be sensitive to expectations regardless of the tax rate—as will be discussed later in the paper.)

The demand relationship can be illustrated graphically. The demand curve, D, for the stock of housing is downward sloping with respect to the real price (Figure 1), because lower housing prices imply lower user costs, everything else being equal. Changes in inflation expectations, the tax rate, the real interest rate or wealth will cause *shifts* in this curve. An increase in inflation expectations, for example, will shift the demand curve outward to D1.

Housing supply and market equilibrium

The equilibrium real price of housing assets is the price that equates the desired stock demand with the actual stock supply. In the short run, the latter is fixed, but in the long run, additions to the stock can be made as long as the real price that clears the market in the short run is above the price implied by long-run supply conditions. The long-run supply curve may not be perfectly elastic with respect to price, however, because one of the factors used in housing production—land—is in fixed supply.

Figure 1

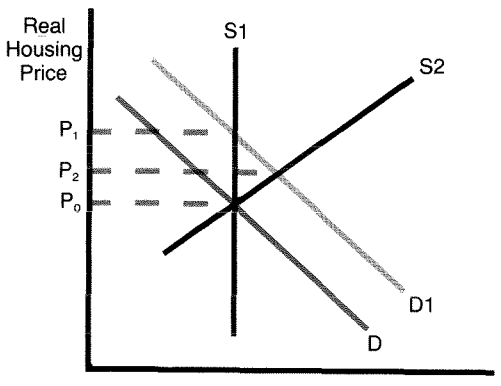


Figure 1 can be used to illustrate the response of housing prices and the housing stock to increased inflation expectations. The curve S1 represents perfectly inelastic supply, and the curve S2 represents more elastic supply conditions, as might prevail in the long run. The market is initially in long-run equilibrium at P_o. An increase in inflation expectations would cause the demand curve to shift from D to D1. In the short run, the real price would rise to P_1, inducing additional supply, until the long-run equilibrium price, P_2, is reached.

This simple model shows that first, the market is always in equilibrium, in the sense that housing-asset prices adjust to equate the desired and actual supply. Unless the long-run supply of housing is perfectly elastic, an increase in inflation expectations will thus cause a long-run increase in real housing prices. Second, this increase in real housing prices is a one-shot affair. For real housing prices to rise continuously relative to general prices, inflation expectations must continually be revised upward.

Third, the model helps distinguish between movements in the price of housing and movements in the user cost of housing. The rise in the real *price* of housing that accompanies an increase in inflation expectations does not necessarily imply that the real user *cost* has risen. On the contrary, in the case of fixed supply and unchanged wealth, an increase in inflation expectations leaves the real user cost unchanged. Otherwise the desired stock (which depends upon the user cost) would differ from the fixed supply. The real price has simply risen to offset the initial reduction in U caused by the increase in inflation expectations, and makes households willing once again to hold the available stock of housing.

Similarly, the real user cost of housing must *fall* in response to an increase in inflation ex-

pectations when supply is elastic. Otherwise, households would be unwilling to hold the increased stock supply that is stimulated by the rise in the real price of housing.

Other variables can also affect the relative movement of housing prices and costs. Consider, for example, the effect of a change in wealth. Unless supply is perfectly elastic, an increase in demand caused by an increase in wealth will cause real prices to rise. Since there is no change in inflation expectations to offset this effect, the user cost must also rise. This is necessary to clear the market for the available stock at the higher level of real wealth.

Finally, consider the effect of an increase in the interest rate (nominal or real). This causes the demand for the housing stock to decrease, everything else being equal. If the housing supply is imperfectly elastic, this will, in turn, cause real housing prices to *fall* and the housing stock to decline. (In Figure 1, demand shifts back from D1 to D and the price falls from P_2 to P_O.) With unchanged wealth, however, the decline in the housing stock can be made consistent with demand only if real user costs are higher in equilibrium.

These examples make it clear that housing prices do not always move in the same direction as the perceived *cost* of housing to the consumer. Indeed, in the examples above, only changes in wealth affected user costs and prices in the same way. Since it is housing *costs* that are relevant to housing demand—and the consumer's welfare—the use of housing prices in the consumer-price index is thus theoretically unsatisfactory and may lead to biased measures of inflation. Indeed, under circumstances of rising inflation expectations, the use of housing *price* data creates the impression that *costs* are rising when precisely the opposite may be true. We will return to this issue later in this paper.

III. The Rental Market

The model of the housing market described above involved owner-occupants only. This approach permitted a simplified presentation while still offering useful insights into the workings of the housing market. Moreover, since owner-occupancy is the dominant mode of housing tenure in the United States, such a simplification is useful in the aggregate. However, this begs an interesting question: why *is* homeownership so dominant?

Frequently it is said that Americans prefer certain features of owner-occupied housing, which differs qualitatively from rental housing. This view suggests that rents and owner-occupant user costs can move with considerable independence; indeed the relative level of these variables would determine the tenure balance. This "segmented markets" approach has been followed in several recent studies of the home-ownership decision.[12] Such an approach, however, seems somewhat *ad hoc*. It is difficult to conceive of important housing *services* that can not be obtained in the rental market; essentially all types of housing are available on a rental basis. There are other distinctions, of course, that arise as a result of the nature of the transactions involved—homeownership may impede mobility, for example—but such transaction costs tend to affect the level of owner-occupant housing costs, and not necessarily their relationship to the market rent for similar housing.

We take an alternative approach, assuming that there is no important distinction between the services of rental and owner-occupied housing, and argue that other factors determine the equilibrium tenure share. In particular, we extend the model to incorporate the different tax treatment of landlords and owner-occupants. We illustrate how taxes alone can make the tenure balance determinate even when market rents, and owner-occupant user costs, are equal on the margin.

Tax policy and the rental market

Both landlords and owner-occupants perceive a user cost of capital associated with ownership of housing. Indeed, if a rented unit

were indistinguishable from an owner-occupied unit—and if there were no difference in tax treatment—the user cost perceived by the landlord would be the same as that perceived by an owner-occupant. A landlord would be unable to charge a rent in excess of this user cost because households, by assumption, can obtain equivalent services through ownership. In such a case, the tenure balance would be indeterminate without additional assumptions about quality differences, tastes, transactions costs, or other factors.

In fact, of course, the tax system alters this simple description in several ways. First, tax law treats property owned by landlords and property owned by occupants quite differently. Unlike owner-occupants, landlords are taxed on the income that flows from their housing stock because that income is "realized" in the form of rental income. Landlords are also more likely to pay taxes on the nominal capital gains they enjoy. Both factors tend to make the breakeven rent that a landlord must charge greater than the user cost perceived by an owner-occupant facing a similar tax rate and level of inflation expectations. For example, assume that the landlord also faces the rate, c, on capital gains. Then the breakeven situation for the landlord is to charge a rent, R, per period, which, after tax, is equal to after-tax user costs. That is

$$R(1-t) = P((r+z)(1+t)-(1-c)z)$$

or

$$R = \frac{1}{(1-t)} P((r+z)(1-t)-(1-c)z).$$

This market rent is clearly greater than the implicit rent or user cost

$$U = P((r+z)(1-t)-z)$$

perceived by a similarly situated owner-occupant. Moreover, it can be shown that rents and owner-occupant user costs respond differently to changes in inflation expectations. In general, for capital-gains tax rates of a reasonable size, an increase in inflation expectations reduces R by less than it reduces U, everything else being equal.[13] This differential sensitivity to inflation expectations, as we shall see, may contribute importantly to changes in tenure patterns.

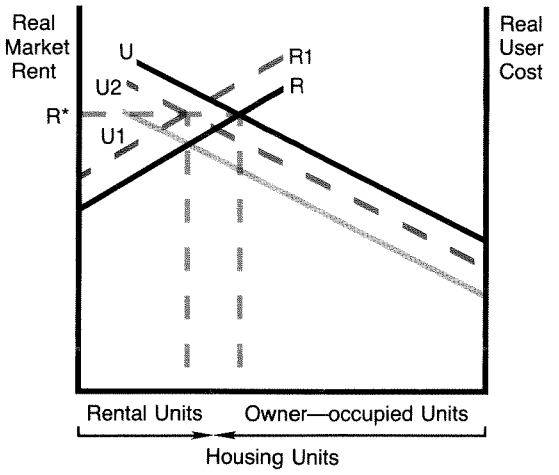
A second important aspect of income-tax policy is the differential impact of different tax rates. Because of the treatment of nominal interest, individuals in higher income-tax brackets perceive lower user costs of housing capital than do individuals in lower income-tax brackets. This applies to both landlords and owner-occupants. Market rents have to be quite high to encourage individuals in low income-tax brackets to own housing, either as landlords or occupants. This makes both the number of rental housing units and the number of owner-occupied units increasing functions of the market rent.

Rental-market equilibrium

These implications of the tax treatment of housing suggest a way to determine the equilibrium rent and tenure balance. First, given the assumption of qualitative equivalence of rented and owned housing, the market rent must equal the user cost of owner-occupancy on the margin. Otherwise some tenants would be motivated to become owner-occupants, or vice versa. Second, the total demand for housing at that rent (or user cost) must be exactly equal to the supply. Otherwise the price of housing would change (thereby affecting rents and user costs) to equilibrate demand and supply. Finally, given the assumption that there are no market imperfections to cause vacant or unused housing, the entire stock must be "supplied" by either landlords or owner-occupants.

The consequences of these conditions, given a fixed supply of housing, can be illustrated graphically (Figure 2). The curve labelled R represents the relationship between the market rent and the ownership or "supply" of rental units. The curve labelled U graphs the same relationship for owner-occupied housing. Both are increasing functions of the market rent (for the reasons given earlier), but are drawn back-to-back to incorporate the assumption of a

Figure 2



fixed total stock of housing. Both curves are drawn for a given price of housing and a given level of inflation expectations.

At the intersection of the supply curves U and R, two of the necessary equilibrium conditions are satisfied: the owner-occupant user cost equals the market rent, R*, and the total stock of housing is allocated between landlords and owner-occupants. As drawn (with a higher landlord-cost relationship) the tenure balance is skewed toward owner-occupancy. If R* also happens to be that rent which makes desired total demand equal to the fixed supply, then the figure fully describes the market equilibrium.

The diagram can be used to study the effect of changes in inflation expectations on rentals and tenure choice, since any factor which affects the user costs of landlords or owner-occupants can be graphed as shifts in the curves R and U, respectively. For example, if increased inflation expectations significantly reduce the user costs of owner-occupants (but not of landlords), then the curve U will shift downward to U1. The intersection of U1 with R describes a lower market rent (and owner-occupant user cost) as well as a further skewing of the tenure choice toward owner-occupancy.

This is not the final equilibrium, however, because the lower cost for both types of tenure will cause aggregate housing demand to exceed the fixed supply. Of course the variable which will move to ration the housing supply is the price of housing. Since supply is fixed, only one rental, R*, clears the market, and housing prices must rise enough to return user costs to this previous level. The increase in prices affects both landlords and owner-occupants, so the R curve shifts to R1 and the U curve shifts to U2 until the opportunity costs are the same as they were before the change in expectations.

Although opportunity costs are unchanged, owner-occupancy has been increased, or to put it somewhat differently, some rental housing has been converted to owner-occupied housing.[14] If aggregate supply were somewhat elastic (rather than fixed), real housing prices again would rise and the tenure balance would change in the direction of owner-occupancy, but real user costs and real rents would remain depressed relative to their initial levels.[15]

Relevance of model

The model presented above suggests that rising inflation expectations have significantly affected recent changes in housing prices, rents, and tenure patterns. Widely observed increases in real housing prices and in the equilibrium quantity of housing can be explained in this fashion. Of course, increases in demand caused by growing numbers of households or expanded wealth might also be responsible for these trends, given a somewhat inelastic supply. However, as the model suggests, such factors would cause real user costs (and, hence, real rents) to rise as well, and no such phenomenon has been observed. On the contrary, real rents have fallen quite consistently for over a decade. *In toto,* the relative behavior of housing prices and rents can best be explained by rising inflation expectations.[16]

Recent increases in owner-occupancy may also have been stimulated in part by the consequences of increased inflation expectations. Analysis of tax law suggests that such expectations may be more beneficial to owner-occupants than to landlords. As a consequence, rising inflation expectations will cause the ten-

ure balance to shift toward increased owner-occupancy to restore the equivalence, on the margin, of the user costs faced by the two types of owners. It should be noted that this tenure shift occurs without movement in the relative *equilibrium* values of rents and user costs. Indeed, market rents are a useful measure of user costs.

By implication, the decline in the share of the housing market owned by landlords is accompanied by a change in the type of taxpayers who find housing ownership attractive on the margin. At reduced real rents, only very high-tax rate individuals remain as landlords, whereas owner-occupancy can be broadened only if relatively low-tax rate households are embraced. Both tendencies are consistent with our analysis concerning the proliferation of homeownership and the poor environment for investment in rental housing.

The analysis also helps explain the condominium-conversion phenomenon. In effect, the model suggests that rental property is converted because rising inflation expectations make the cost of holding a unit of housing in a household's portfolio lower for that household than for a landlord.[17] Tax policy makes the housing more valuable to potential owner-occupants than to the landlord, and conversion brings about the necessary redistribution. In reality, of course, actual conversion decisions depend upon changes in taste, landlords' fears of rent controls, and other factors. However, the model offers an economic rationale for this phenomenon that does not depend upon such ambiguous variables.

IV. Other Considerations

A highly simplified asset-stock demand model thus appears to be useful in analyzing present-day housing trends, at least in a casually empirical manner. A number of other considerations deserve discussion, however, because of their policy or empirical implications.

Credit-market imperfections

One such consideration concerns the effect of certain lending conventions on the behavior of the housing market. Lenders regularly employ loan-qualification standards which limit loan-income ratios, such as the ratio of monthly loan payments and the borrower's current monthly income. Critics argue that this practice, combined with the convention of a fixed payment mortgage, causes "affordability" problems as rising inflation expectations (and, hence, rising nominal interest rates) cause monthly loan payments to rise relative to income. (An unstated corollary of this view is that the rise in housing demand and prices can then only be explained by increases in wealth or by population-based demand pressures.)[18]

There is good reason to believe, however, that the "affordability" problem thus may have been only a minor element in recent housing-market trends. First, the qualification constraint may not be effectively binding in the long run because of changes in lender behavior. An increase in inflation expectations does not affect the ultimate "security" of a loan. Neither the present value of a fixed-payment loan, nor the present value of a borrower's income, differ at different *levels* of inflation expectations. Thus profit-oriented lenders have an incentive, as inflation expectations rise, to relieve the borrower of the constraint imposed by the qualification standard. This relief may take the form of a broadened income definition (which recognizes the spouse's income, for example), more liberal interpretation of qualification standards, or pressure on regulators to develop mortgage instruments (such as the graduated payment mortgage) which help borrowers overcome the cash-flow burden imposed early in the life of the typical fixed-payment mortgage.

Second, individuals have some ability to rearrange their asset portfolios so as to mitigate an undesired constraint on the amount of mortgage liabilities they hold in their portfolios. In particular, individuals may dissave to make larger contributions to home equity, and thereby reduce their mortgage requirements.

Finally, and most importantly, the notion of an increasingly binding "affordability" constraint is inconsistent with observed housing-market trends. A borrowing constraint, in effect, tends to raise the user cost of housing capital and, therefore, tends to raise real rents in equilibrium.[19] But if this constraint had tightened in recent years, real rents should have *risen* rather than fallen as they apparently have done. Of course, the possibility remains that loan-qualification practices and "cash flow" constraints have had some effect, but have been overwhelmed by other factors.

Speculation and the housing market

Our model suggests that inflation processes can produce changes in real housing prices during the transition period while the housing market adjusts to a new level of inflation expectations. With unchanged expectations about the general rate of inflation—and with housing-price expectations linked to these general expectations—prices would rise only at the rate of prices in general. Why, then, have we seen a relatively sustained rise in real housing prices over the last decade or so? One possibility that is consistent with the model is a frequent upward revision in overall inflation expectations—understandably so, since households were buffeted by an acceleration of *actual* inflation during this period.

Another possibility—one that is compatible with the popular notion of a "speculative bubble"—is the potentially self-reinforcing nature of the movements in housing demand and housing prices. This view, argues, in effect, that households have formed their housing inflation expectations separately from "general" inflation expectations (as incorporated in nominal interest rates), and that they have relied heavily on past housing-price movements to form these expectations. With such an adaptive model, it is easy to construct a scenario with an explosive rise in real housing prices, in the following manner. A real increase in housing price (however initiated) would cause individuals to expect additional increases. (In the language of our model, h increases more than z.) This, in turn, causes housing demand to rise and stimulates further increases in real housing prices. With further increases in expectations, the process of rising real prices continues until some other factor intervenes and dampens or reverses expectations. With the process reversing, the "bubble" can then burst in a crescendo of falling real housing prices.

Such a scenario seems to be implicit in many popular discussions of real-estate booms and crashes.[20] The relevance of "price bubbles" in asset markets has been questioned, however—on an empirical if not a theoretical level—by economists working within the framework of "rational expectations" theory.[21] Thus, we are led to conclude that the explanation for recent housing-market developments should be sought in changes in general inflation expectations, rather than separately formed housing expectations.

V. Empirical Analysis

Our analysis appears to offer a description of housing-market behavior that is consistent, in a very general way, with observed market trends. However, there are a number of advantages to exploring the implied relationships in a more rigorous way. First, since many other factors may influence the housing market, it would be useful to observe the significance of the statistical relationship between housing-market trends and inflation expectations. Second, empirical analysis might shed some light upon several unresolved theoretical issues. For example, does a representation of *general* inflation expectations satisfactorily explain housing prices and rent relationships, or is it necessary to add *housing* inflation expectations as well? Also, is "affordability" a factor in the behavior of the housing market?

Rental-price relationship

To explore these issues, we employ two relationships derived from the earlier discussion. The first is the equilibrium condition that real rents should equal owner-occupant housing

costs, or

$$R = P((1-t)(r+z)-h+f)$$

which may be rewritten

$$R/P+h = (1-t)\,i+f$$

where f represents the effects of depreciation, maintenance, insurance and property taxes—assumed to be a constant proportion of the value of the stock. If overcoming a cash-flow constraint imposes costs on a household in proportion to the nominal interest rate, then

$$R/P+h = (1-t+a)i+f$$

where "a" is the cash-flow proportion. With the aid of regression analysis and information on i, h, and R/P, we can obtain estimates of f and the coefficient on i. We can then compare these estimates with *a priori* notions to obtain a crude indication of the consistence of the model with the data.

We estimated this linear relationship using quarterly data and two different classes of assumptions concerning the formation of housing-price inflation expectations. In the first model, we assumed that households expect housing prices to rise at the same rate as prices of goods overall. In the second model, we employed a separate variable, assuming that housing inflation expectations are formed adaptively. (See Appendix A for details on the construction of these measures.) Each model was estimated using both ordinary least squares (OLS) and a Cochrane-Orcutt technique for treating serially correlated errors.

Outside estimates of the marginal tax rate, t, suggest values in the .20 to .30 range and a figure of 5 to 7 percent for the fraction of real housing value represented by maintenance, depreciation, property taxes and other value-based components of user costs (Table 1).[22] On this basis, the first model performs quite well. The marginal tax rate (.27) and the maintenance factor (8.8) are quite precisely estimated and near the anticipated values, if we assume that the affordability constraint (measured by "a") is not significant.

The second model performs less well, in a statistical sense, and is sensitive to the estimation technique. In the Cochrane-Orcutt version, for example, the constraint term is indistinguishable from zero. More importantly, however, a large affordability constraint (that is, a large "a" coefficient) is necessary to yield reasonable tax-rate estimates. Thus, in this model at least, the finding of an affordability constraint is linked with the assumption of separately formed housing inflation expectations.[23] Since there is little empirical evidence to sup-

Table 1
Regressions on the Rental/Price Relationship, 1965.I to 1978.IV

			Regression Coefficients				Implicit Point Estimates	
Model	Housing Price Inflation Expectations Assumption	Estimation Technique	Constant	Nominal Interest Rate	R^2	D.W.	Tax Rate	Depreciation, Maintenance, et. al. (%)
1a.	Same as consumption prices in general	OLS	8.92 (15.42)	.722 (9.55)	.69	1.21	.28(+a)	8.9
1b.	Same as consumption prices in general	Cochrane-Orcutt	8.83 (9.31)	.734 (5.93)	.70	1.94	.27(+a)	8.8
2a.	Housing expectations formed separately	OLS	8.62 (3.60)	1.10 (3.53)	.41	1.06	−.10(+a)	8.6
2b.	Housing expectations formed separately	Cochrane-Orcutt	5.07 (0.92)	1.44 (2.14)	.54	1.90	−.44(+a)	5.0

NOTE: t-ratios are in parentheses. The dependent variable is R/P+h. The independent variable is a distributed lag on the nominal interest rate, i. See Appendix A for additional computational details.

port the existence of "speculatively" formed expectations in asset markets, we are inclined to reject the finding of an affordability constraint as well. In light of the combined evidence, therefore, there appears to be little support for the notion that housing inflation expectations are formed separately (at least as modelled), or that "affordability" is an important factor in the housing market.

Levels of prices and rents

The model also identified the factors that should affect the *levels* of real housing prices and real rents. In particular, under conditions of imperfectly elastic supply, real housing prices should be positively related to housing inflation expectations and household wealth, and negatively related to the interest rate, everything else being equal. We have argued that real rents, on the other hand, should behave in the same way as user costs. Thus, following our earlier arguments, rents should be negatively related to housing inflation expectations and positively related to wealth and the interest rate, everything else being equal.

These implications can be tested by regressing data on real housing prices and real rents, respectively, on measures of inflation expectations, the interest rate, and household wealth. However, a lagged measure of the housing stock, because of its probable sluggish adjustment, must also be included in the regression. Everything else being equal, a larger existing supply implies lower housing prices and rents.[24]

All of the signs of the estimated coefficients are consistent with the thesis we have presented under the assumed circumstances of imperfectly elastic supply (Table 2).[25] Increases in wealth per household (proxied by real disposable permanent income) cause both prices *and* rents to rise. Increases in the nominal interest rate decrease real housing prices but, as expected, cause real rents to rise as the resultant low prices cause reductions in the housing stock. The effect of capital-gains expectation is captured by the sign of the coefficient on inflation expectations. It indicates that increases in housing inflation expectations increase real housing prices, but reduce real rents as suppliers respond to high prices by adding more housing to the stock.

Finally, the significance of the coefficient on the lagged housing stock suggests that stock adjustment is, indeed, a sluggish process; the existing stock is an important determinant of current prices and rent levels. The coefficient has a negative sign, as expected, because increases in the existing stock reduce both real prices and rents, everything else being equal. Since the coefficient on the housing-stock variable in the long-linear regression can be interpreted as an elasticity, the real housing price apparently is quite responsive to changes in the existing stock. A one-percent change in the lagged stock supply results in over a two-percent change in the price. In a world in which the housing supply is imperfectly elastic and adjustment processes are sluggish, this is consistent with inelastic housing-stock demand.

Table 2
Price and Rent Regressions, 1965.I to 1978.IV
(all variables in log form)

	Constant	Nominal Interest Rate	Inflation Expectations	Permanent Income/Household	Lagged Real Housing Stock/Household	R^2	D.W.
1. PRICE	−7.9	−.30	.58	1.7	−2.8	.98	2.3
	(2.6)	(6.5)	(7.8)	(4.0)	(4.7)		
2. RENT	−1.0	.063	−.13	.55	−1.6	.99	1.6
	(1.0)	(1.6)	(5.26)	(4.0)	(8.0)		

NOTE: t-ratios presented in parentheses. See Appendix A for additional computational details.

VI. Policy Implications

Rising inflation expectations apparently have been closely involved in the recently observed pattern of rising housing prices, falling real rents, and—by implication—a shrinking rental-housing sector. However, we have found no evidence to suggest any similar separate influence of housing-price inflation expectations, as in models of speculative price bubbles. Similarly, trends in real rents suggest that "affordability" has had little if any impact on recent housing trends. A number of policy implications flow from these results and from our earlier discussion.

Housing crisis

Inflation has been at the root of many of the industry's recent changes—but this does not mean that inflation has caused a crisis in the form of unaffordable housing or unavailability of rental housing. In general, properly measured housing *costs* have fallen relative to other prices despite the rise in housing *prices*. The trend away from rental housing, including the conversion of rental housing to owner-occupancy status, represents a natural consequence of households' attempts to cope with the combined impact of inflation and tax regulation. Some communities have tried to address the "loss" of rental housing to condominiums by blocking conversions, but that "solution" actually reduces households' aggregate welfare, because it blocks their attempts to find the lowest-cost housing alternative.

Disparate tax treatment of the two types of property appears to be the basic cause of the shift away from rental housing in an inflationary era. The trend could be reversed, perhaps, if owner-occupants' implicit rental income were included in their taxable income, and if landlords' depreciation allowances reflected market rather than historic value. Public-finance economists have frequently proposed such changes on grounds of tax equity, but the political realities argue against their acceptance, especially in view of the longstanding policy commitment to encourage homeownership.

Nonetheless, the distortion by inflation on housing patterns is arbitrary and thus unlikely to be socially optimal. In addition, the distortion is not confined to choices within the housing market. The combination of inflation and special tax treatment tends to alter relative rates of return *within* housing, and also *between* housing and other assets in the economy. (In terms of tax treatment, incidentally, a landlord's housing investment is analogous to investment in general.) Thus, capital that otherwise would have flowed into industrial uses frequently has been attracted to housing instead. Trends in the composition of household portfolios verify a dramatic shift by households out of financial assets (including corporate equities) into housing assets.[26] Thus the true "crisis" may be that too much—rather than too little—housing is produced and consumed in our economy.

Inflation and the CPI

More indirectly, inflation's impact on housing aggravates a problem created by the incorrect treatment of housing in the consumer-price index. The appropriate measure of housing costs—that is, the measure that is relevant to demand and welfare analysis—is the opportunity cost or user cost of housing. Although this measure depends importantly on price expectations and is inherently impossible to observe directly, theory suggests that it should move with market rentals.

In contrast, CPI procedures developed in the 1950's to reflect homeownership costs confuse costs of *purchasing* the asset with various costs involved in holding the asset per period.[27] The consumer-price index currently employs weighted data on the price of new homes (part of the CPI's "home purchase" component) and mortgage interest costs (the component "contract mortgage interest costs"), in addition to property taxes, insurance, and maintenance and repair. The home-purchase and mortgage-interest components, with a weight of about 17 percent in the overall CPI, increase sharply in magnitude as inflation expectations rise. But

as we have seen, this is exactly when real housing *costs* tend to fall. The current CPI procedures thus lead to severe overstatement of the contribution of housing to inflation.

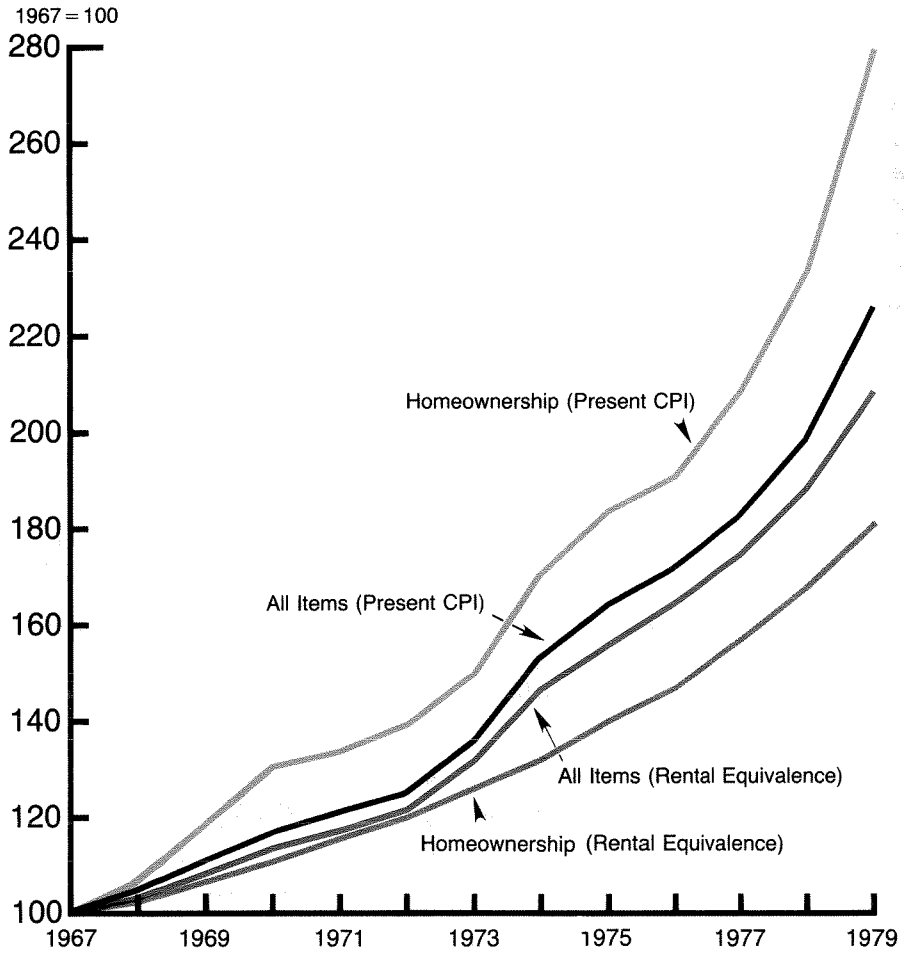
A conservative estimate of the overstatement can be derived from experimental "rental equivalence" measures developed by the Bureau of Labor Statistics.[28] The CPI apparently was at least 8 percent higher in 1979 than it should have been, due to overstatement of housing costs during the 1968-79 period (Chart 4). Considering the myriad public and private programs and contracts which use the CPI as an inflation index, such an overstatement itself has introduced inflation-related distortions into the economy.

Mortgage policy

Finally, some brief observations may be made concerning the relationship between mortgage instruments and the housing market. The general trends in the data and the simple regression analysis presented here are not consistent with the notion of severely binding cash-flow constraints on housing. However, our tests are admittedly weak, and it is impossible to say whether the standard fixed-payment mortgage and mortgage lenders' qualifi-

Chart 4

Alternative Housing Cost Measures and Inflation



cation standards are completely unimportant, or are simply overwhelmed by other factors. Policies to relieve the constraint—such as promoting graduated-payment mortgages or equity-sharing arrangements with lenders—should help cause housing demand to increase if the constraint has been at least somewhat binding. With given supply conditions, this should lead to an increase in the real price of housing, though not by enough to fully offset the reduced implicit costs of housing assets.

VII. Conclusion

In our analysis, rising inflation expectations—interacting with the tax treatment of housing—help account for several major recent trends in the housing market. Our emphasis on inflation expectations is not meant to deny the influence of other factors. Indeed, the maturing of the "baby boom" generation, local restrictions on new housing investment, and the proliferation of single-headed households all have contributed to rising real housing prices. However, the lack of evidence of any rise in user costs (as proxied by real market rents) suggests that such factors have not been the dominant force in stimulating rising housing prices. Moreover, our analysis suggests that the housing "crisis" is not one of widespread unavailability of housing at reasonable costs. On the contrary, inflation and the tax structure may have encouraged too great a commitment of resources to housing, and may have created further distortions because of the mismeasurement of housing costs in the CPI.

Appendix A
Computational Details

This study utilized quarterly U.S. data series throughout. The following is a list of the sources of the data, with manipulations performed as noted.

Price. A real housing-price index was constructed with the C-27 data of the U.S. Department of Commerce, which relate to the price of new one-family houses, including the value of the lots. This index is for a unit of fixed characteristics, and was deflated by the personal-consumption expenditures deflator.

Rent. A real rental index was constructed with the rental survey component of the consumer-price-index, deflated by the personal-consumption expenditures deflator.

General Inflation Expectations. A number of series were tested. The one employed in the regressions is from Scadding (1979), based on analysis of the inflation forecasting implicit in consumption behavior.

Housing Inflation Expectations. A number of series were tested. The one employed in Table 1 is an eight-quarter, third-degree polynomial distributed lag on the change in nominal housing prices.

Housing Stock. The real value of the housing stock per household was obtained from the Bureau of Economic Analysis (U.S. Department of Commerce) estimates of the value of fixed, residential capital in the U.S. The series is reported in the *Survey of Current Business*. This annual series was interpolated quarterly using the quarterly measure of the number of housing units.

Households. Annual data on the number of households is reported in the Bureau of the Census, Current Population Reports, Series p-20. Quarterly values were interpolated.

Nominal Interest Rate. The AAA corporate-bond rate is employed as a measure of the nominal interest rate. The mortgage rate was also tested, but a useful series could not be obtained because of variations in the features of the instrument over time. In addition, an open-market rate such as the AAA bond rate more accurately reflects the opportunity costs of housing equity.

Permanent Income. An estimate of permanent income per household was obtained with data on disposable personal income, and with an estimation method described in Darby (1974).

Rental/Price Ratio. The benchmark ratio of nominal rents and prices was obtained from data from the 1975 National Housing Survey. The rental-price index and the housing-price index reported above were used to complete the series.

Econometric Methods. All of the reported regression estimates were obtained with the use of ordinary least-square methods. An eight-quarter, third degree, unconstrained polynomial distributed-lag structure was employed on the components of the opportunity-cost variable in the regressions reported. This was done because the opportunity-cost variable should theoretically be entered separately for each period into the future; we have assumed that a household's forecast of these future values is contained in current and recent past estimates of the opportunity cost. (The regressions were also run using contemporaneous values only; the results were qualitatively similar.)

FOOTNOTES

1. See, for example, Feldstein, Green and Sheshinski (1978).

2. The best data are available for *new* housing only. However, theory would suggest that the prices of close substitutes (existing homes, for example) would move similarly. The available data suggest that this is, indeed, the case.

3. Increased quality accounts for approximately 15 percent of the increase in average sales prices of homes sold in the period 1970–79. The data on new housing prices and characteristics are available in U.S. Bureau of the Census Reports C-25 and C-27.

4. Data on housing tenure are available from the Current Population Survey of the Bureau of the Census. There is some lack of comparability between this relatively recent source of data and the decennial census that makes comparisons of tenure patterns over time difficult. Moreover, we are primarily interested in the **value-weighted** tenure share, to control for quality changes. One such attempt to create this type of data (published periodically in U.S. Department of Commerce, **Survey of Current Business**), also shows an acceleration in owner share, however.

5. See the Annual Housing Survey, General Housing Characteristics, Part A.

6. See, for example, S. Nicholson, "Rental Housing: Why Don't the Numbers Work?" **Building,** December 1979.

7. "Apartment Trends," **U.S. Housing Markets,** March 1980, p. 10, and **Rental Housing: A National Problem that Needs Immediate Attention,** Report to Congress by the Comptroller General, General Accounting Office, November 8, 1979, p. 11.

8. "Condo Conversions: '79's Boom Won't Bust," **Housing,** March 1980, p. 35, and "Apartment Trends," **U.S. Housing Markets,** September 1979, p. 10.

9. See, for example, N. Mayer (1977).

10. See, for example, A. Polinsky (1979).

11. See, for example, W. E. Diewert (1974). In the view taken here, wealth is considered to be an exogenous variable and therefore appears as an argument of the demand relationship. If wealth is viewed as endogenous, then the optimal stock of an asset depends only on opportunity costs if the asset's services are easily marketed. Hess (1977) tests and rejects the exclusion of wealth from asset-stock demand relationships.

Although, conceptually, opportunity costs for each period in the future are separately relevant to asset-stock demand, we assume that inflation expectations are constant over the entire planning horizon, and thus the entire time path can be represented by a single period's opportunity costs.

12. See, for example, Rosen and Rosen (1980).

13. Ignoring depreciation, a profit-maximizing landlord adds to his housing stock until after-tax rental income equals the (after-tax) cost of carrying the stock per period. That is, until

$$(1-t)R = ((1-t)(r+z) - (1-c)z)P$$

where t is the landlord's effective capital-gains tax rate. (Note the assumption, for simplicity, that $h=z$.) Thus

$$R = ((r+z) - z(1-c)/(1-t))P$$

relates the market rental and expectations. By comparison, owner-occupant opportunity costs are

$$U = ((1-t)r - tz)P$$

under similar conditions. Clearly, in the extreme case where capital gains are treated like ordinary income, $t=c$ and $\delta R/\delta z = 0$. That is, landlord costs are unaffected by inflation expectations. Even for lower capital-gains tax rates, however, landlord costs will not decline as much as owner-occupied housing costs as long as $t^2 \leq c$. The tax treatment of depreciation causes further offsets in the cost-reducing effect of rising inflation expectations, because the historic-cost basis of landlords' depreciation allowances causes the depreciation deduction to fall in real value as inflation rises. See, for example, de Leeuw and Ozanne (1979) and Feldstein, Green and Sheshinski (1978). In addition, a non-tax feature—the fear of rent control—may cause landlords to feel that their future income or capital gains are compromised by rising inflation. This may be an important factor in some markets and it is one that deserves separate attention; for simplicity, however, we treat these effects as an element of a "tax" policy toward rental housing since it, too, has the effect of making the breakeven rent less favorably sensitive to inflation expectations.

14. This approach is in sharpest contrast to that of Rosen and Rosen (1980), in which changes in tenure patterns are related to differences between the *equilibrium* levels of rents and opportunity costs. They do not detail the model which underlies their analysis, and it is not clear why rents and opportunity costs should not move together, although their empirical work assumes that this is the case.

15. A technical appendix describing a mathematical version of the model is available from the author.

16. A securely rising marginal tax rate and/or a falling real interest rate could also contribute to this effect. Indeed, these may represent additional avenues through which inflation-induced distortions can affect the housing market. Marginal tax rates can rise as the result of "bracket creep"—the effect of a progressive tax-rate structure applied to nominal income. Feldstein and Summers have also argued that inflation (coupled with tax policy) can reduce aggregate loan demand and, hence, the (real) interest rate. (See Feldstein and Summers, "Inflation, Tax Rules and the Long Term Interest Rate," **Brookings Papers on Economic Activity,** Volume 1, 1978.) Although these effects are not specifically addressed in this paper, they are consistent with the general notion that inflation-induced distortion, rather than income or demographics, is the primary factor behind relative price and rent movements in the housing market.

17. See, for example, the viewpoints cited in "Legislating to Restrain Coops and Condos," **Business Week,** February 18, 1980, p. 90–91.

18. The most careful study of "affordability" is Kearl (1979). However, Kearl attempts to measure the effects of "affordability" constraints by including the initial mortgage payment in his regressions. It is not clear that a useful proxy for this effect can be devised, since the true shadow price of the constaint is unobservable. In addition, the variable used by Kearl is highly correlated with the nominal mortgage rate, which would have the sign he finds in his analysis irrespective of affordability problems.

19. See A. Hess, "Credit conditions and Automobile Demand," University of Washington (mimeo), August 1976 and March 1980, revised. See also van Order and Villani (1979), who propose a less general form of constraint.

20. A recent popular version of this hypothesis is presented in Cardiff and English (1979).

21. See, for example, R. Flood and P. Garber, "Market Fundamentals versus Price-Level Bubbles: The First Tests," **Journal of Political Economy,** September, 1980.

22. This is the range of tax rates implicit in the relative rates of return of taxable and non-taxable securities of similar quality, as well as the tax on interest income, estimated using Colin Wright's technique from IRS statistics. (See Colin Wright in Harberger, 1969.) The real-estate industry uses an estimate of one percent of market value each for maintenance and depreciation, although a higher figure for both is probably justifiable. (See Laidler in Harberger, 1969) Property taxes average 2.5 percent of market value. Insurance and expected uninsurable losses likely add less than one percent. Finally, in the context of our model, transactions costs and any costs due to the "liquidity" of the housing asset must be added to these other components.

23. Indeed, the fact that Kearl (1979) employs this assumption and finds an affordability constraint may be related.

24. The model may be solved for the absolute level of real housing prices and rents by making some assumptions about supply conditions. That is, we have assumed that prices move to equate the stock demanded with the available total stock, or to preserve

$$D(U,W) = D(R,W) = K,$$

where K is the available housing stock. However, K is not fixed, but rather is itself a function of real housing prices. Specifically, if one imagines the housing industry responding with a lag to changes in the real price,

$$K - K_{-1} = d(K^*(P) - K_{-1})$$

where K^* is the long-run stock supply implied by the current real price and d is a constant or function denoting the relationship between actual and long-run changes in the stock. Thus in general the supply relationship may be written

$$K = K(P,K_{-1})$$

and P may, in principle, be derived from the solution of stock demand and this supply condition or,

$$P = P(u, W, K_{-1}) = P(i, z, W, K_{-1}).$$

Similarly, R may be determined as

$$R = R(P, W, K_{-1}) = R'(u, W, K_{-1}) = R'(i, z, W, K_{-1}).$$

25. If supply were perfectly inelastic (with respect to the real price), increases in the interest rate would depress real prices, but not affect market rentals; conversely, if supply were perfectly elastic, an increase in the mortgage rate would not affect the real price but would depress real rentals. Our finding that both are affected is consistent with the notion of imperfectly elastic supply.

26. See Kane (1980).

27. The method of constructing the housing component is detailed in "Housing Costs in the CPI," **Monthly Labor Review,** February 1956, pp. 184–196.

28. Janet Norwood, "The Consumer Price Index Puzzle," **Challenge,** March–April, 1980, pp. 41–45, Tables 1 and 2. This is conservative because the weights employed in the "rental equivalence" series are based on expenditures and do not incorporate capital-gains effects on income.

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