The Markets for Housing and Housing Services

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Francisco Arcelus and Allan H. Meltzer

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(Continued on inside back cover)
The Markets for Housing and Housing Services*

In the U. S., and in most other developed countries, decisions about purchasing, producing, and financing housing and housing services have not been left to the unrestricted market decisions of individuals, or other private decision making units. With few exceptions, governments have adopted national housing policies to modify the decisions that would be reached in the market place. The legislated U. S. goal, "a decent home and a suitable living environment for every American family," [report on National Housing Goals, 16, p. 1] is to be achieved by constructing or rehabilitating 26 million housing units by 1978.

One principal basis for the development of national housing goals is the belief that, if left unassisted, many households would purchase less housing and fewer housing services than legislatures, other centralized decision making units, and perhaps the public tend to regard as socially desirable.

A second reason commonly offered as an explanation of public interest in housing is that relatively large fluctuations in the production of housing are said to be a consequence of public policies, particularly monetary policies. The most common explanation of the relatively wide swings in housing starts is that attempts to slow inflation by monetary policy raise interest rates, and attempts to expand production and employment by monetary policy lower interest rates. Large changes in

*We are indebted to Richard Roll, William Silber, and Craig Swan for helpful comments and suggestions, to Louis Barba and John Stastny for whetting our interest, to Karl Brunner for his contributions over many years, to the National Science Foundation for research assistance, and to the National Association of Home Builders and particularly Nathaniel Rogg and Michael Sumichrast for their assistance, prodding, encouragement, and criticisms.

Francisco Arcerus is a graduate student and Allan H. Meltzer is Maurice Falk Professor of Economics and acting dean of the School of Industrial Administration, Carnegie-Mellon University. Publication of this article is made possible by the support of the Center for Research in Government Policy and Business, University of Rochester.
interest rates are said to affect housing directly and more importantly by changing either the rate of increase or the volume of deposits at the principal mortgage lending institutions. Most discussions of fluctuations in housing markets conclude that fluctuations in housing starts are the result of previous or contemporaneous fluctuations in market interest rates and the availability of mortgage credit. In the words of two prominent housing analysts [10]: “No matter how housing problems are defined, credit has almost invariably been singled out as the key to the solution.” This consensus or near-consensus on the importance of mortgage credit appears to rest on nothing more substantial than a blend of conjecture and casual empiricism. Comparisons of time series showing market interest rates and housing starts show that the two series generally move inversely, but raise questions about timing. Housing starts have declined well before the peak in interest rates on several occasions, both during the 1960s and in the 1920s. Comparisons of housing starts or housing expenditure and deposits at thrift institutions show an undeniable positive association but raise many questions about timing and inverse movements during particular subperiods.

Attempts to measure the elasticity of housing demand with respect to interest rates have often found the interest elasticity to be relatively low, no more than \(-0.25\) when computed for stocks\(^1\) [14, 13]. Studies for the Home Loan Bank Board [11, 5] did not find evidence of a significant effect of mortgage credit on the demand for housing. Yet despite careful statements by these authors, the report’s principal author faithfully repeats the standard conclusion [7, p. 113]: Housing is said to be severely affected by monetary policy via the “capital rationing effect, resulting from deficiencies in current institutional arrangements for providing mortgage credit”.

Public policy toward housing in the U.S. and abroad takes the importance of low interest rates and the availability of mortgage credit as well established. In the U.S., policymakers defended the control of deposit rates under Regulation Q as a device for increasing housing production by increasing the amount of mortgage credit available. We have found no evidence to support this conjecture. Mortgages are purchased by the Federal National Mortgage Association, the Government National Association, and by the Home Loan Bank to encourage housing production. Similar or alternative programs are common in Western Europe.

The claim that governments can damp fluctuations in the production of housing by offering additional mortgage credit to compensate, at least partially, for the reduction in the volume of mortgages offered by traditional mortgage lenders leaves open whether the expected stimulus to production and sales is provided by more lending at prevailing rates, or by the lower mortgage rates expected to result from an increase in the supply of mortgages. Moreover, the usual discussion ignores any effect on interest rates and the demand or supply of housing resulting from the financing of the additional deficit.

To a general economist, the emphasis placed on the supply of mortgage credit is

\(^1\)A recent, unpublished paper (Brady) reports an interest elasticity of the demand for housing in the neighborhood of \(-2\) using current production as the dependent variable.
one of the most unusual aspects of the discussion of the economics of housing. There is no other branch of economics in which financing is considered so important a determinant of production or purchases. Nor is there another branch of economics in which scarce resources receive so little emphasis and financial variables so much.

There are several problems with the standard discussion. Most notable is the failure to distinguish between high rates and rising rates, actual rates and anticipated rates, market rates and real rates. If market rates rise and are expected to remain permanently at their new level as the result of an increase in the anticipated rate of long-run inflation, there is no reason to believe that the demand for housing is permanently reduced. Once wages, prices, and interest rates adjust to a higher (or lower) anticipated rate of inflation, there is no reason to expect any sizeable decline in the demand for housing or housing services. At higher real rates of interest, households substitute future for current consumption, lend more, borrow less, and reduce indebtedness, including mortgage debt. Fewer housing services are demanded and fewer houses are built.

Economic theory offers an alternative explanation of the much discussed relation among deposits at thrift institutions, the mortgage market, and homebuilding. Interest rates are the costs of deferring consumption of goods and services, not simply the cost of borrowing from a financial institution. Rising market interest rates encourage households to defer purchases of durables; falling market interest rates encourage households to increase purchases. High interest rates on marketable bonds induce households to shift from deposits at thrift institutions, where rates adjust slowly, to marketable securities, where rates adjust more quickly. Low interest rates induce an opposite shift.

Both explanations imply that there is a positive correlation among the volume of deposits at thrift institutions, the flow of mortgages, and the number of houses built. Both imply a negative correlation between these variables and market interest rates. The difference between the two is in the analysis of a change in the supply of mortgage credit and in the implications for government policy toward the mortgage market. On the usual explanation, an increase in the supply of mortgages, at given rates of interest, increases the demand for houses. The alternative explanation denies that a change in the amount of mortgage credit offered at a given rate of interest has any significant effect on the number or the real value of houses built. The correlation among housing starts, mortgages, and interest rates is seen as the result of two separate relations: (1) higher market interest rates induce households to defer (and lower interest rates to increase) long-term borrowing and purchases of long-lived assets; and, (2) higher open market rates also induce the public to shift financial assets from thrift institutions to marketable securities; lower interest rates induce a shift in the opposite direction.

In the following sections, we introduce and test a model of the housing market that is capable of discriminating between the two explanations. We use the model and the estimated parameters to analyze the effects of policies designed to damp fluctuations in housing starts. Our estimates permit us to draw some additional
conclusions about the effects of growth, inflation, and monetary and fiscal policies on housing. We interpret some of the main findings in our conclusion.

I. A MODEL OF THE HOUSING MARKET

The existing stock of houses consists of buildings of various ages, sizes, and qualities. At any point in time, the available stock of housing yields a flow of housing services. If we treat the short-run flow of housing services as fixed by the given stock and follow the procedure described by Muth [14], the demand for housing services determines the price of a unit of housing services. We will call this price the rental price per unit of housing service, or rent.

For a tenant, the value of housing services purchased per period is the amount spent for rent. For an owner, expenditure on housing services is an opportunity cost, the amount he would pay to rent a comparable unit after allowances for difference in tax treatment, depreciation, maintenance, and the like. To measure the real value of housing services, we deflate expenditure on housing services by the rental price of a standard unit. We use an index of rental prices to measure the price paid for a standard unit.

The number of units of housing services demanded by the household can be derived by maximizing a utility function subject to a budget constraint. We posit that the individual's demand for housing services depends on income or wealth, the price of a unit of housing services, and prices of other goods and services. The aggregate demand for housing services is the sum of the individual demands.

Let $h$ be the number of units of housing services demanded. Equation (1) is the aggregate demand function for housing services.

$$h = h \left( R, p, \frac{B}{p}, \frac{S}{p} \right)$$

where $h > 0$, $h_1 < 0$, $h_2, h_3, h_4 > 0$

$R$ is the price per unit of housing services, $p$ the price of other goods and services, $y$, a measure of real income or expected real income from the sale of productive services, $B/p$ and $S/p$ are items of net wealth, the first the real stock of base money, the second the real stock of government debt outstanding. The aggregate amounts of $B/p$ and $S/p$ record the heritage of past monetary policy and the financing of fiscal policy. Gold and foreign exchange inflows, the financing of government deficits by the central bank, and open market purchases expand the monetary

Given the anticipated rental prices, the equilibrium number of vacancies and the equilibrium vacancy rate are determined by the demand for housing services in our model. Frequent changes in anticipated rental prices relative to prevailing prices would change the flow of services from a given stock and falsify one part of our hypothesis.

For a discussion of the definition of wealth used here, see Brunner and Meltzer [3] and Brunner [2]. Although the sign of $B/p$ is expected to be positive, our analysis suggests that the response of housing expenditure to a change in $B/p$ depends on the ratio of base money to total wealth and is, therefore, likely to be small.
base. Gold outflows, retirement of government debt held by the central bank, and open market sales reduce the monetary base. Government deficits financed by borrowing from the banks and the public increase the amount of government debt held by the private sector. Increases in the real value of the base increase real wealth and the demand for housing services. We do not know whether the real stock of debt is a substitute for or complement of housing services, so the sign of $S/p$ in equation (1) is uncertain.

The amount of new housing units produced or demanded in a given year depends on the state of the market for housing services. Changes in population or in other demographic variables, conditions prevailing on financial markets, as represented by the terms or conditions demanded by mortgage lenders [11, 13], the number of vacant houses, and other variables are often introduced into the demand function for new housing units. We assume that demographic variables affect the demand for new housing units by changing the demand for housing services and the prices, or rents, paid for the use of the existing stock. The effect of additional mortgage credit at given interest rates is discussed below.

In a growing community, the demand for housing services increases. Rental prices for the existing stock of houses rise, and opportunities for profitable investment in new rental units increase. The rise in rental price relative to the cost of new units also stimulates the demand for single-family houses. In a declining community, the price of rental units and the opportunity cost of owner-occupied houses decline relative to the price of new units. Fewer new units are demanded or built, so the stock of housing shrinks or grows less rapidly.

In a competitive market, profits accrue to those who correctly anticipate the market's future demand. "Speculative building," building in anticipation of demand, is a prominent characteristic of the U. S. housing markets. As the rental price rises, the expected return from constructing new housing increases. We postulate that the expected return on new construction depends on the rental price and that the supply of housing depends on the relation between rental price, $R$, the market price at which new units are sold, $p_h$, and the cost of producing a unit. Equation (2), the aggregate supply function for new housing, expresses the relation between housing production, costs and prices.

$$HS = s(R, L, i, p_h) s_1, s_2 > 0; s_3 < 0$$

$L$ is the cost per unit of labor time or the real wage rate in construction, and $i$ is the market rate of interest. The latter measures the opportunity cost of capital employed in the production of new houses. Much of the capital investment in housing is obtained by borrowing from financial institutions. Changes in $i$, therefore, are a useful measure of short-term changes in the cost of capital to the housing industry. The number of houses produced (the number of housing starts) increases as the price of housing increases and declines as the costs of construction rise.

The demand for new housing units is shown as equation (3).
HS = d \left( R, \dot{h}, i, \frac{B}{p}, \frac{S}{p}, E, p_h \right) d_1, d_2, d_4, d_6 > 0 \tag{3}
\quad d_3, d_5, d_7 < 0

All of the arguments of the demand function except \( E \), owners' equity in houses, have been introduced before. We postulate that real wealth and real demand are positively related, so increases in \( E \) increase the demand for housing. The symbol \( h \), instead of \( h \), denotes that demand depends on anticipated rather than actual expenditure on housing services. The reason is that families anticipate increases in housing expenditure and purchase new houses in advance of delivery. Purchases of multiple family units also increase in anticipation of a rise in housing expenditure. We postulate that a rise in anticipated expenditure on housing services increases the current demand for houses. We note only that the real stock of debt, \( S/p \), is assumed to be a substitute for real capital including capital invested in housing and that, in principle, \( i \) is a vector of rates on financial assets including mortgages.

Our approach places main emphasis on the interaction between the markets for housing and housing services. The rental price of housing services and the expenditure on housing services link the two markets. Increased demand for housing services raises the rental price. Higher rental prices encourage consumers to acquire substitutes for existing housing services and encourage builders to increase the production of substitutes, so both the demand for and supply of new housing increase. The increase in the supply of housing adds to the stock available in future periods and the flow of housing services, offsetting part of the initial rise in rental price. At the new equilibrium, as in the old, the rental price \( R \), and the purchase price \( p_h \), are at values that maintain the production of new housing units at a rate sufficient to maintain a constant flow of housing services per period.

II. SOME EVIDENCE FROM THE TIME SERIES

We assume that equations (1)-(3) are linear in the logarithms of the variables and subject to errors with zero mean and constant variance. Using annual data for the period 1915-40 and 1948-68, omitting the years of price and rent control, we estimate equation (1) by ordinary least squares and equations (2) and (3) by two stage least squares. Principal data sources are described in an appendix.

The least squares estimates of the real demand for housing services 1915-40 and 1948-68 are:

\[
\begin{align*}
  h &= -1.24 + 0.91 p - 0.51 R + 0.94 y + 0.06 \frac{B}{p} - 0.15 \frac{S}{p} \\
  &\quad (-2.02) (9.55) (-2.94) (5.42) (0.64) (-5.04) \\
  R^2 &= .98 \\
  DW &= 0.77
\end{align*}
\tag{1}
\]

All variables are as defined before; \( h \) is deflated by the rental price, \( R; p \) is the implicit price deflator for GNP; permanent or expected income is used in place of cur-
rent income to accord with the findings of a number of studies [DeLeeuw, 4] and real consumption expenditure is used as a measure of expected income; \( B/p \) and \( \delta/p \) are the stocks of real base money (adjusted for changes in reserve requirement ratios) and real government debt held by the banks and the public. Numbers shown in parentheses below the estimates are \( t \)-statistics. \( DW \) is the Durbin-Watson statistic.

Our findings indicate that the demand for real housing services is a negatively sloped function of the rental price and is dependent on real income, prices and the real value of financial assets. Only one of the computed elasticities is less than twice its standard error. All other computed elasticities are significantly different from zero by the usual standard.4

The income elasticity of the demand for housing services is the subject of an extensive literature. Several studies have now found that income elasticities are higher when some measure of permanent or expected income is used in place of current income. DeLeeuw's [4] careful summary and comparison of many very different estimates from cross-section studies reduces the range of estimates considerably by eliminating difference due to measurement procedure and the like. DeLeeuw concludes [4, p. 10] that for renters the income elasticity of housing expenditure is between 0.8 and 1.0, and for owners the elasticity is most likely above 1.0. A later survey of cross-section and time series estimates [Geisel, 8] also suggests the income elasticity is approximately one. Our computed elasticity, 0.94, is in the middle of DeLeeuw's range for renters and within one-third standard error of unity.

The actual expenditure on housing in any year, \( h \), differs from anticipated expenditure, \( \hat{h} \), because random occurrences affect the demand for housing services. On our hypothesis, the demand for housing depends on anticipated, or planned, expenditures. Let \( \hat{h} \) be the error-free value of expenditure on housing services obtained from the least-squares regression. We assume that each individual or household acts as if equation (1) holds with certainty when planning the demand for new housing, so that \( \hat{h} \) is the aggregate planned expenditure on housing services.

Most of the other variables in the demand function for housing have obvious empirical counterparts. The exceptions are, \( E \), the value of owners' equity, \( p_h \) the price of housing, and \( i \), the vector of interest rates. The difficulties of obtaining reliable time series for the nominal housing stock or owners' equity and adjusting for price changes are discussed by Goldsmith [Goldsmith et al., 9]. An additional problem is that Goldsmith's data have not been extended to include most recent years. Using Goldsmith's data requires the sacrifice of observations for the years in which there has been considerable experimentation with housing programs and relatively large fluctuation in housing starts.

We chose an alternative procedure that extends our previous argument and permits a test of the alternative explanations of housing demand. If the flow of housing services is proportional to the stock of housing, as we assumed above, the

4The sole exception is the base. For reasons mentioned in the previous footnote, we expect the computed elasticity of consumption expenditures with respect to the base to be small.
value of owners' equity in a given stock can be measured by the reciprocal of the real value of the outstanding stock of mortgage debt. Data on the stock of mortgage debt are readily available.

The use of the real stock of mortgages as a measure of the equity in the housing stock permits us to test for the effect of mortgage credit and "availability." If an increase in the stock of mortgages increases the demand for housing, as is widely believed, the coefficient of the mortgage stock in the demand equations will be positive. If the coefficient of the mortgage stock is negative, we will interpret the results as evidence supporting our hypothesis. If the loan-to-value ratio is an important determinant of the demand for housing, as is often suggested, the size of changes in the stock of mortgages is positively related to the size of the changes in the housing stock; with a given housing stock, large changes in the mortgage stock increase demand more than proportionally and small changes increase demand less than proportionally. The standard error of the positive coefficient of mortgage debt should be large relative to the coefficient in a linear or log linear regression of the demand for housing, if the hypothesis is correct. A significant negative coefficient for the mortgage stock casts doubt on the importance of loan-to-value ratio and suggests that observed loan-to-value ratios, like the ratios of debt to equity are determined by market conditions and particularly by interest rates and other relative prices. To further test the results, we then substitute a measure of the flow of mortgage credit for the stock of mortgages, re-estimate the reduced form equation for \( p_H \) and the demand equations for housing.

Reliable time series for the prices of housing are also difficult to obtain. We used two measures, the Boeckh index and the average cost of new housing units. Neither is an adequate measure of market prices. Both gave similar results, so we report only the set of results using the Boeckh index.

Measurement of interest rates poses a somewhat different problem. There are many, closely related rates on financial assets but no reliable measures of interest rates on mortgages for the period covered by our study. If there is credit rationing or disequilibrium in the mortgage market, the real stock of mortgages and the rates of interest on open market securities do not fully describe the position of the mortgage market. Lacking data on mortgage rates, we are forced to assume that the stock of mortgages and open market interest rates adequately summarize the position of the mortgage market for each of the years in our study. Fortunately, evidence from quarterly models of the mortgage market, developed in recent years, supports us very well. The volume of mortgage borrowing has been found to be highly elastic with respect to mortgage rates in different time periods and using very different estimating equations [5, 12, 17]. Most of the response of mortgage rates to changes in the volume of mortgages occurs within a year.

Table 1 shows our estimates of four demand and four supply equations for housing. \( HS \) is the number of new housing starts, \( HS1 \), single family starts, \( HS2 \), two-family starts, and \( HS+ \) multiple family starts. As before, all variables are logarithms.

The data support the hypothesis moderately well. The principal determinants of
TABLE 1
Elasticities Computed from Demand and Supply Equations for Housing, 1915-40 and 1948-68*

<table>
<thead>
<tr>
<th>Variable</th>
<th>( h )</th>
<th>( R )</th>
<th>( i )</th>
<th>( B/p )</th>
<th>( S/p )</th>
<th>( \hat{p}_H )</th>
<th>( (SMD)/p )</th>
<th>( R^2 )</th>
<th>( DW )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Equations</td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>( HS )</td>
<td>0.66</td>
<td>4.35</td>
<td>-1.75</td>
<td>0.71</td>
<td>-0.24</td>
<td>-0.40</td>
<td>-0.69</td>
<td>0.94</td>
<td>1.44</td>
</tr>
<tr>
<td></td>
<td>(1.14)</td>
<td>(7.78)</td>
<td>(-5.92)</td>
<td>(2.25)</td>
<td>(-1.59)</td>
<td>(-0.48)</td>
<td>(-0.09)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( HS1 )</td>
<td>0.33</td>
<td>3.67</td>
<td>-1.36</td>
<td>0.83</td>
<td>-0.23</td>
<td>-0.16</td>
<td>-0.59</td>
<td>0.95</td>
<td>1.59</td>
</tr>
<tr>
<td></td>
<td>(0.69)</td>
<td>(7.90)</td>
<td>(-5.53)</td>
<td>(3.16)</td>
<td>(-1.77)</td>
<td>(-0.22)</td>
<td>(-4.20)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( HS2 )</td>
<td>0.20</td>
<td>6.51</td>
<td>-1.07</td>
<td>1.02</td>
<td>-0.53</td>
<td>-0.66</td>
<td>-1.24</td>
<td>0.86</td>
<td>1.20</td>
</tr>
<tr>
<td></td>
<td>(0.23)</td>
<td>(7.83)</td>
<td>(-2.43)</td>
<td>(2.19)</td>
<td>(-2.37)</td>
<td>(-0.53)</td>
<td>(-4.90)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( HS+ )</td>
<td>1.82</td>
<td>5.68</td>
<td>-1.02</td>
<td>0.56</td>
<td>-0.30</td>
<td>-1.98</td>
<td>-0.49</td>
<td>0.75</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>(1.25)</td>
<td>(4.01)</td>
<td>(-1.36)</td>
<td>(0.70)</td>
<td>(-0.79)</td>
<td>(-0.93)</td>
<td>(-1.13)</td>
<td></td>
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<tr>
<td>Supply Equations</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>( L )</td>
<td>( R )</td>
<td>( i )</td>
<td>( \hat{p}_H )</td>
<td>( R^2 )</td>
<td>( DW )</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( HS )</td>
<td>-0.95</td>
<td>3.68</td>
<td>-2.05</td>
<td>0.29</td>
<td>0.89</td>
<td>0.72</td>
<td></td>
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<tr>
<td></td>
<td>(-3.88)</td>
<td>(8.71)</td>
<td>(-7.92)</td>
<td>(1.77)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( HS1 )</td>
<td>-0.69</td>
<td>2.89</td>
<td>-1.78</td>
<td>0.41</td>
<td>0.91</td>
<td>0.91</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>(-3.37)</td>
<td>(8.17)</td>
<td>(-8.20)</td>
<td>(3.00)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( HS2 )</td>
<td>-2.25</td>
<td>6.35</td>
<td>-1.70</td>
<td>-0.97</td>
<td>0.75</td>
<td>0.63</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(-6.21)</td>
<td>(10.16)</td>
<td>(-4.43)</td>
<td>(-4.04)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( HS+ )</td>
<td>-2.48</td>
<td>4.38</td>
<td>-0.68</td>
<td>-0.18</td>
<td>0.64</td>
<td>0.50</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>(-0.45)</td>
<td>(4.60)</td>
<td>(-1.17)</td>
<td>(-0.49)</td>
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</table>

* t-statistics in parentheses.

supply are prices and costs. The principal determinants of demand are relative prices, particularly the rental price of housing services and interest rates. Financial variables, the stocks of base money and debt, generally play a significant role. The log of the real value of the existing stock of mortgages, \( SMD/p \), has a negative coefficient in each of the demand equations.

The interest elasticities of the demand and supply equations provide considerable support for the proposition that housing is a postponable expenditure. Our estimates imply that cyclical changes in interest rates of ±0.5 or 0.6 around a mean 5 percent market rate of interest would induce changes of 15 to 20 percent in the demand for housing. Moreover, the effect on the demand for housing is reinforced by the effect on supply. The computed interest elasticities of the supply equations are also comparatively large and negative.

The negative coefficient for \( SMD/p \) implies that, with interest rates and other variables remaining unchanged, increases in the real stock of mortgage debt reduce the demand for housing and decreases in the stock increase demand. There is no plausible interpretation of these findings—repeated in each of the demand equations—that is consistent with the standard, and frequently repeated, emphasis given to mortgage credit as a determinant of demand. We interpret the negative coefficient as reflecting the positive effect of increased housing equity on current demand, as our hypothesis requires. We interpret the relatively large t-statistics for \( SMD/p \) in most of our equations as evidence that the loan-to-value-ratio has little independent effect on demand. The demand for multiple-unit housing starts, \( HS^+ \)
may be an exception to the last conclusion. The coefficient of $SMD/p$ is a much smaller multiple of its standard error than in the other demand equations suggesting that loan-to-value ratios may exert an influence on demand.

To further test the effect of mortgage credit on the demand for housing, we substitute the real flow of mortgage credit for the real stock. Let $FMD/p$ measure changes in the real stock of mortgage credit. To avoid negative signs for the annual data, we use the percentage growth rate of the real stock as our measure of the flow of mortgage credit. $FMD/p$ is the log of the percentage growth rate, the period change in the logarithm of the real stock.

Table 2 shows the revised estimates. All symbols again denote logarithms of the variables, so all the coefficients are elasticities. As before, the demand equations are two stage least squares estimates using the appropriate reduced form equation for $p_h$.

Replacing the stock of mortgages with our measure of the flow of mortgage credit changes the results considerably. The coefficient of $p_h$ changes from negative to positive. The coefficients of $i$ and $B/p$ fall, become negative and, in most cases, lack statistical significance. $R^2$ is lower in the four $FMD$ equations, and the coefficient of $FMD/p$, though positive, is not significantly different from zero by the usual test. Moreover, the effect of mortgage flows on the demand for housing vanishes when we include both the stock and the flow of mortgages in the demand equations (see Table 4).

The demand equations containing the flow of mortgage credit are not as well supported by the data as the equations containing the stock of mortgages. We conclude, from the comparisons of the two sets of demand equations, that there is, at best, weak evidence of the important, often predominant, role assigned to mortgage credit as a determinant of the demand for housing. Our results imply that the principal arguments of the demand equations for housing are interest rates, rental prices and our measures of wealth—the real stocks of debt and base money and owners' equity in housing.

### Table 2

The Effect of Additional Mortgage Credit on the Demand for Housing
1915–40 and 1948–68*

<table>
<thead>
<tr>
<th>Demand Equations</th>
<th>$\hat{h}$</th>
<th>$\hat{R}$</th>
<th>$\hat{i}$</th>
<th>$\hat{B}/p$</th>
<th>$\hat{S}/p$</th>
<th>$\hat{p}_h$</th>
<th>$(FMD)\hat{p}$</th>
<th>$R^2$</th>
<th>$DW$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$HS$</td>
<td>-0.07</td>
<td>2.12</td>
<td>-2.20</td>
<td>-0.20</td>
<td>-0.40</td>
<td>1.35</td>
<td>1.45</td>
<td>0.90</td>
<td>0.96</td>
</tr>
<tr>
<td></td>
<td>(-0.11)</td>
<td>(3.27)</td>
<td>(-6.10)</td>
<td>(-0.66)</td>
<td>(-2.28)</td>
<td>(1.71)</td>
<td>(1.47)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$HS1$</td>
<td>-0.49</td>
<td>1.74</td>
<td>-1.74</td>
<td>0.08</td>
<td>-0.41</td>
<td>1.61</td>
<td>1.12</td>
<td>0.91</td>
<td>1.11</td>
</tr>
<tr>
<td></td>
<td>(-0.89)</td>
<td>(3.06)</td>
<td>(-5.50)</td>
<td>(0.31)</td>
<td>(-2.65)</td>
<td>(2.33)</td>
<td>(1.24)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$HS2$</td>
<td>-1.50</td>
<td>3.11</td>
<td>-2.08</td>
<td>-0.58</td>
<td>-0.89</td>
<td>2.82</td>
<td>1.14</td>
<td>0.69</td>
<td>0.68</td>
</tr>
<tr>
<td></td>
<td>(-1.35)</td>
<td>(2.76)</td>
<td>(-3.30)</td>
<td>(-1.08)</td>
<td>(-2.87)</td>
<td>(2.05)</td>
<td>(0.66)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$HS+$</td>
<td>2.24</td>
<td>4.52</td>
<td>-1.45</td>
<td>-0.26</td>
<td>-0.17</td>
<td>-2.08</td>
<td>1.09</td>
<td>0.72</td>
<td>0.71</td>
</tr>
<tr>
<td></td>
<td>(1.68)</td>
<td>(3.30)</td>
<td>(-1.91)</td>
<td>(-0.46)</td>
<td>(-1.26)</td>
<td>(0.52)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* $t$-statistics in parentheses.
III. IMPLICATIONS FOR HOUSING POLICIES

The housing market equations permit us to trace the effects of many different policies, and types of policies, on the distribution of housing demand by type of housing, on housing cycles, and on the demand for housing services. In this section, we consider two main types of policy action. We begin with an analysis of the effects of general economic policies, policies that produce long-run growth, and the standard monetary and fiscal policies that are used to damp fluctuations in output, employment, and prices.

Economic policy, particularly monetary policy, is often said to have a very large effect on the demand for housing. The total size of the effect has not been measured, and previous computations of the interest elasticity of demand do not carefully separate the effects on demand from the effects on supply. Our equations yield separate estimates and therefore permit us to compute the expected change in housing starts per dollar of open market operations or per dollar of government deficit. Below we present these estimates.

Then, we consider a second type of policy—governmental actions undertaken with the specific purpose of stabilizing the housing market. Policies of providing additional mortgage credit or purchasing and selling mortgages are often used to offset the alleged or actual effects of monetary policy on housing. Policies of reducing labor monopolies in the construction industries are discussed as an alternative means of increasing the supply of housing and housing services.

General Policies

To analyze the effect of policy changes on the markets for housing and housing services, we differentiate equations (1)-(3) and use the resulting equations to obtain solutions for the changes in $HS$, $p_h$ and $R$ that are required to restore equilibrium. Except as noted, we do not consider additional effects on the housing markets resulting from induced changes in prices, real wages, real income, interest rates, and the values of financial assets. Each of the latter variables is treated as exogenous or predetermined relative to the housing sector, and the induced response of these (predetermined) variables to changes in housing is not known precisely. Some general idea of the size of the feedback from induced changes to housing market variables can be obtained, however, by combining the results for specific policies. For example, if open market purchases induce inflation, we sum two results given below to obtain the total response to the change in money and the price level.

With the price level, income, and interest rates taken as determined outside the housing sector, we are left with three equations in four variables—the relative rates of change of $h$, $HS$, $p_h$, and $R$. By our previous assumption $h$ is proportional to the stock of housing. By making the relation between the equilibrium rates of change of housing starts and the stock of housing explicit, we can eliminate the rate of change of $h$. We then use the parameter values in Table 1 and for equation (1) to compute the expected responses to housing policies.
Let the real housing stock, $H$, grow at a steady rate, $n$, and depreciate at a steady rate, $d$. The equilibrium number of housing starts $HS$ equals $(n + d)H$. By our previous assumption, $h$ equals $kh$. The equilibrium flow of housing services becomes a fixed proportion $k/(n+d)$ of the number of housing starts, and $dHS/HS = dh/h$. Substituting the percentage change in $HS$ for the percentage change in $h$, we can solve for equilibrium rates of change in $HS$, $p_h$, and $R$.

Table 3 shows the results for five policies. Policy (1) maintains steady growth and price stability. By assumption, the monetary base, real income, real wages, and the stock of mortgage debt grow at a steady rate (1 percent). Prices and interest rates remain unchanged. Total housing starts, one-family units and multiple family units increase by .85 to .90 percent per year, and rents rise by approximately .2 to .3 percent. Two-family starts, $HS_2$, grow much more, suggesting that this type of housing increases relatively, as the economy grows. The finding is not consistent with the experience of the past forty years, nor is the finding that prices fall. This equation is unsatisfactory.

At first glance, our computations seem to suggest that after a prolonged period of steady growth without inflation, there would be fewer houses per capita or per capita.

<table>
<thead>
<tr>
<th>Policy</th>
<th>Changes in the Economy</th>
<th>Changes in Housing Market Equilibrium (in percent)</th>
<th>Comments and Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) steady growth and price stability</td>
<td>$y, B/\rho, SMD/\rho, L$ increase by 1% per year</td>
<td>$HS + .85, R + .29, p_h + 2.52$</td>
<td>price level and interest rates unchanged</td>
</tr>
<tr>
<td>(2) an anticipated increase in the price level</td>
<td>first $p$ increases by 1% and $t$ rises by 1 percent. point $p$ increases by 1% per year, interest rates unchanged</td>
<td>$HS - .85, R + .30, p - 2.52$</td>
<td>real wages and real values of financial assets unchanged</td>
</tr>
<tr>
<td>(3) an unanticipated increase in prices and money wages</td>
<td>$S/\rho, B/\rho$ fall by 1%, $p$ increases by 1%</td>
<td>$S + .89, B/\rho + .21, p + .38$</td>
<td>interest rates are unchanged; real financial assets decline</td>
</tr>
<tr>
<td>(4) budget surplus used to retire debt</td>
<td>$S$ declines by 1% and interest rates fall (see text)</td>
<td>$S - .22, R - .15, p_h - .27$</td>
<td>price level and real expenditure unchanged</td>
</tr>
<tr>
<td>(5) open market purchase</td>
<td>$B$ rises 1%, $S$ and $t$ fall</td>
<td>$B + .62, S - 1.00, t - .15$</td>
<td>prices, real wages and real income unchanged</td>
</tr>
</tbody>
</table>

TABLE 3 Effects of Economic Policies on Housing Markets
family unit and more crowding. In fact, this would be true only if population and income grow at the same rate. If population growth is less than 85 percent of the growth rate of real output, as in the United States during this century, housing starts per capita rise with real income.

The growth in housing starts tells nothing about changes in the quality of housing units. One problem in using housing starts to analyze the growth of housing is that data on starts provide no information about changes in the size and convenience of housing units, in the relative price of land or in the real services yielded by a housing unit. Some of these changes are included in $p_h$ however. One of the main deficiencies of available data on the price of housing is that measured price changes are based on costs of construction and inadequately separate price and quality changes or do not separate the two at all. Hence some part of the relatively large rise in $p_h$, predicted by our analysis of steady growth, measures the increase in the quality of housing services, in housing space per capita and in other real changes that accompany growth in real output. Changes in land prices are excluded from $p_h$ by construction.

There is no reliable way of separating the quality and price components of $p_h$. If we assume that the productivity of housing units increases at the average rate of productivity increase for the economy or the service sector, almost half the increase in $p_h$ represents an increase in the real value of housing services. Adding the predicted growth rate of starts to the increase in real services and adjusting for population growth implies that per capita real expenditure on housing rises more than twice as fast as real income. If we use the term “total elasticity of demand for housing services” to refer to the ratio of the percentage change in per capita housing services to the percentage change in real income, the “total elasticity” computed in this way is in the range suggested by one earlier study [15]. The remaining change in $p_h$ could then be interpreted as the increase in the relative price of housing units brought about by increased relative demand.

The assumption that the quality or productivity of housing services rises at the average rate of productivity increase in the service industries is appealing and is no more arbitrary than any one of a number of alternative assumptions that we have tried in our attempts to separate the quality and price components of $p_h$. One such alternative is to assume that the ratio of rent to $p_h$ remains constant in a growing economy. The difference between $p_h$ and $R$ in Table 3 can then be used as a measure of additional growth in demand for housing services. Adding this difference to the growth rates of $HS$ places that “total elasticity of demand for housing” between 1.85 for apartments and 3.14 for single-family units before adjustment for changes in population. The elasticity for total $HS$ is, then, approximately, a weighted average of the two, and is again above 2.

On almost any plausible assumption, part of the predicted increase in $p_h$ should be added to the predicted increase in housing starts to obtain the predicted change in the demand for housing in an economy with steady growth and no inflation. Whatever the method used to adjust the increase in $p_h$ for changes in the quality of housing, our results almost certainly imply that demand for housing is income
elastic. Housing is a luxury. One reason is that with progressive income tax rates or rising tax rates, the right to deduct payments for interest and local property taxes increases in value. With steady growth at constant prices and interest rates, the demand for housing space and housing quality increases raising the price of housing relative to other prices. The broad movement of relative prices lends some support to this explanation. A second explanation, also consistent with the data, is that as population density increases, the demand for housing space increases relative to the growth of population increasing the size of housing units and the price per housing start.

Our findings for $HS$, $HS_1$, and $HS^+$ are so similar under a policy of steady growth that we do not report separate responses for $HS_1$ and $HS^+$ to each of the other policies in Table 3. In the rest of our analysis, we consider only total housing starts unless otherwise noted.

Policies 2 and 3 produce inflation (or deflation)--steady anticipated inflation in one case, once-and-for-all unanticipated inflation in the other. There are two parts to our analysis of policy (2). At first, market interest rates rise by the same percentage as the anticipated rate of increase in the price level. Thereafter interest rates remain at their new level and prices continue to rise at a steady (1 percent) rate per year. Since the inflation is fully anticipated, real wages and the real value of financial assets are unaffected. In policy (3), money wages and prices are assumed to increase in proportion, so real wages are again unchanged. Since the price increase in policy (3) is an unanticipated one-time occurrence, equilibrium interest rates remain unchanged, and holders of government debt and money are taxed in proportion to their holdings. The real wealth of creditors, including mortgage lenders, declines. However, the redistribution of wealth resulting from the change in the real value of mortgage debt has no effect on the demand for housing. Private creditors gain what private debtors lose.

A comparison of the effects of a steady increase in prices and a once-and-for-all change shows that the annual percentage changes in $HS$ and $R$ are approximately the same. The small difference between the two is the result of a difference in initial conditions. The real value of financial assets declines under policy (3) but not under policy (2).

Housing markets are very responsive to changes in interest rates. The adjustment of market interest rates to a maintained 1 percent increase in the price level (policy 2) lowers housing starts by 2.5 percent and increases rental and housing prices by approximately 7 and 11 percent. These relatively large, once-and-for-all changes depend very much on the level of interest rates prevailing at the start of the infla-

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5Between 1900 and 1936, recorded housing prices and the price level rose at approximately the same rate. Much the same is true for sub-periods. After 1926, housing prices rose relative to the price level. The ratio of $p_h$ to $p$ increases from approximately 1 to 1.8 between 1936 and 1968, a period with considerably higher average tax rates than the earlier period.

6On the alternative assumption that the increase in the real wealth of mortgage debtors increases the demand for housing, the predicted changes for policy (3) are approximately

$$HS = +.92, \quad R = +.14 \quad \text{and} \quad p_h = +1.36$$
tion. The reason is that an increase of one percentage point in the rate of inflation is a considerably larger percentage change in market rates at low rates of interest. If we retain the assumption of constant elasticities, the response of housing market variables to the changes in interest rates induced by anticipated inflation declines as the rate of interest rises.7

Policies (4) and (5) show the effects of two standard monetary and fiscal operations. A government budget surplus used to retire government debt stimulates the production of housing by lowering interest rates and reducing available substitutes for private capital. Policy (4) shows that a 1% reduction in the stock of government debt held outside the Federal Reserve and the government agencies, a decline of approximately $2.25 billion at current levels, induces a small increase in housing starts. Analysis of policy (5) shows that an open market purchase is considerably more potent than debt retirement. In (5) the Federal Reserve increases the monetary base and reduces the stock of government securities held by the public. A percent change in the monetary base at current levels is approximately $800 million; the equivalent reduction in $S$ is $\frac{1}{3}$ percent.

To complete the analyses of policies (4) and (5), we need to supplement our analysis with an estimate of the changes in interest rates induced by changes in the monetary base and the stock of debt. In a recent paper, Eckstein and Feldstein present a regression equation that contains many of the variables of interest to us. Equation (10) of their [Eckstein and Feldstein, 6, p. 368] implies that a 1 percent increase in the real value of the monetary base lowers market rates by .08; a 1 percent increase in the real stock of government debt held by the public raises rates by .015. To convert these values to the percentage changes in interest rates required for our analysis, we use an interest rate of 4 percent, the average rate from the middle-fifties to the middle-sixties used to obtain their estimates. At current rates, the elasticities would be lower and the induced changes in the housing market would be smaller.8

Combining the results for policies (4) and (5) implies that a budget deficit of $25 billion financed by increasing the monetary base by $3\frac{1}{2}$ percent and increasing the stock of debt held by the public 10 percent leaves housing starts unchanged. Maintaining these financial policies until equilibrium is restored in the credit and housing markets lowers interest rates, rental and housing prices. The effect of an open market operation that produces a once-and-for-all change in prices can be obtained by combining the results shown as policies (3) and (5). If open market sales of 3 percent induce a 3 percent deflation, housing starts fall by 4.5 percent.

These and other combinations permit comparisons of the effects of alternative policies on housing markets. One clear implication of any such analysis is that policies that produce large fluctuations in market interest rates induce large changes in housing starts, directly and by changing the prices of housing and housing

7At a 4 percent market rate, the approximate average rate from 1954 to 1968, the changes in HS, R, and $p_h$ become -4.8, +11.3, and 17.2 respectively. At a 10 percent interest rate, the percentage changes are approximately -1.4, 4.6, and 7.5.

8The statement requires qualification. It assumes that if the equation was reformulated and constant elasticities were estimated the revised equation would have to be rejected.
services required for equilibrium in the housing market. Postponement and acceleration of demand and production in response to the changes in market prices and interest rates induced by current and past economic policies appear capable of generating the very large cyclical changes in housing starts observed in the twenties and in the postwar period.

**Stabilizing Housing Markets**

Much of the government’s activity in mortgage markets consists of selling bonds and using the proceeds to purchase mortgages. Or, occasionally, the operation is reversed; mortgages are sold and bonds are retired. FNMA, GNMA and the Federal Home Loan Bank Board are among the principal agencies that operate programs of this kind. Difference in the purchase or sale procedure are of little concern. The net effect is the same in each case; a government bond or a guaranteed obligation replaces the equivalent amount of mortgage debt in the portfolios of private holders.\(^9\)

The main issue raised by programs of this kind is much older than the programs. For more than a century, some bankers, economists, politicians and financial writers have argued that the specific forms in which loans are made—the composition of credit—affects relative interest rates and the composition of output. This view was a central tenet of the Banking School in the nineteenth century. Housing, agricultural, educational, and other credit programs testify to its continued influence in our own day.

An alternative view was first presented by Thornton and Ricardo at the start of the nineteenth century, and numerous others have followed their path and advanced the analysis. In this view, money and credit are fungible. Loans given for one purpose can be used for another, and there is no necessary or expected relation between the composition of credit and the composition of output. Attempts to facilitate housing by changing the composition of credit to increase the volume of mortgages have no effect.\(^10\)

Assume that a government agency or intermediary sells enough bonds to purchase 1 percent of the outstanding stock of mortgages. Assume, further, that the mortgage lender uses all of the receipts from the sale to acquire mortgages. At current values, 1 percent of the stock of mortgages, $3 billion, is approximately equal to 1.4 percent of the stock of debt held by the public. Again, using the Eckstein and Feldstein equation \([6, eq. (10)]\) for interest rates provides an estimate of the rise in

\(^9\) Differences in timing of response and in the size of initial effect may result from different policies. The Home Loan Bank lends only to member institutions. The initial effect on these institutions of Home Loan Bank purchases is larger than the offsetting effect of the sale of bonds in the open market to finance the operation. To the extent that the operation hides a subsidy to member institutions, members gain at the expense of non-members and benefit from an increase in Home Loan Bank activity relative to activity at other government lending institutions.

\(^10\) At times, mortgage market operations are the means by which subsidies are granted to homeowners or financial institutions. For example, a government agency may offer more than the market price for a particular type of mortgage. The effect of the subsidy is in no way altered if it is separated from the purchase program and granted directly. Our analysis considers only the effect of the purchases and sales.
market rates required to absorb the additional government debt into private portfolios. Interest rates rise by 0.5 percent.

The short-run effect on the demand for housing starts is the sum of three changes: (1) the $\frac{1}{4}$ percent rise in interest rates multiplied by the elasticity of housing demand with respect to interest rates, $-1.75$; (2) the effect of a 1.4 percent increase in the stock of government bonds is given by the elasticity $HS$ with respect to $S/p$, $-0.24$; (3) the effect of the 1 percent reduction in the stock of mortgage debt, $0.69$. The combined effect is a small reduction in the demand for housing starts, $-0.5$ percent or about 10,000 starts at current levels.

The short-run effect of the mortgage purchase on the supply of housing starts is slightly larger. The supply response is obtained by computing the product of the interest elasticity of supply and the percentage change in market interest rates. The product is $-1.0$ percent, approximately 20,000 housing starts at current levels. Again, the result is contrary to the usual interpretation. Mortgage purchases reduce the supply of housing starts.

The longer-run effect on the housing markets can be computed from our three equations by solving for the equilibrium rates of change in $p_h$, $R$, and $HS$ just as we did in our analysis of general policies. The results are similar to the short-run demand effects. Housing starts fall by $-0.28$ percent; $R$ and $p_h$ rise by 0.15 and 0.60 percent. Again, the effects are in the direction opposite to the usual claim.

Because the alternative view is so frequently heard and so widely accepted, we have searched for evidence that would substantially alter the above findings. We have found none, neither in our own work nor in the work of others. In contrast to the usual presentation which consists of graphs showing that the series on mortgage

<table>
<thead>
<tr>
<th>TABLE 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response of Housing Starts to Mortgage Credit*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elasticity of Supply Computed from Equations Including a Measure of:</th>
<th>the stock of mortgages $\frac{SMD}{p}$</th>
<th>changes in the stock $\frac{FMD}{p}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$HS$</td>
<td>$-0.13$ ($0.48$)</td>
<td>$-0.08$ ($0.09$)</td>
</tr>
<tr>
<td>$HS1$</td>
<td>$-0.14$ ($0.58$)</td>
<td>$0.11$ ($0.14$)</td>
</tr>
<tr>
<td>$HS2$</td>
<td>$-0.58$ ($1.36$)</td>
<td>$-0.71$ ($0.51$)</td>
</tr>
<tr>
<td>$HS+$</td>
<td>$0.31$ ($0.48$)</td>
<td>$-2.13$ ($1.01$)</td>
</tr>
</tbody>
</table>

Demand and Supply Elasticities Computed from Equations including Measures of the Level and the Change in the Stock:

<table>
<thead>
<tr>
<th>Demand equations</th>
<th>Supply equations</th>
</tr>
</thead>
<tbody>
<tr>
<td>$HS$</td>
<td>$-0.68$ ($3.79$)</td>
</tr>
<tr>
<td>$HS1$</td>
<td>$-0.59$ ($3.98$)</td>
</tr>
<tr>
<td>$HS2$</td>
<td>$-1.23$ ($4.55$)</td>
</tr>
<tr>
<td>$HS+$</td>
<td>$-0.45$ ($0.98$)</td>
</tr>
</tbody>
</table>

* $t$-statistics in parentheses.
credit and housing starts are inversely related, we have computed the effects of the stock of mortgages and the flow of mortgages and of both the stock and the flow of mortgages on the demand for housing starts, on the supply of housing starts and on both the demand for and the supply of housing starts. Table 4 presents some of the computed elasticities and their t-statistics. Except for the negative effect of the stock of mortgages on demand, none of the elasticities is significant. None of our findings seems capable of altering the conclusion that the effect of mortgage credit on housing is small and insignificant. If we were required to choose an expected value for the combined effect, based on our study, and allowing for the effect of the operation on mortgage rates [12, 17] we would choose zero.

The conclusion is not as surprising as it may seem at first to those who have worked in housing markets. Economic theory implies that financial variables have very little lasting effect on real variables. Houses are no different in this respect than other assets. The supply and demand functions depend on relative prices, wealth or income, anticipations, tastes and productive opportunities, not on the amount of credit made available in one form or another. If our findings are correct, the form in which credit is granted is far less important than is commonly believed.

Increasing Technology and Reducing Union Monopolies

Another common assertion about housing is that production cost could be reduced if available technology were used more fully. The observation that lies behind the assertion, and perhaps the main base on which it rests, is that in recent years wages of construction workers have risen relative to wages in other sectors of the economy. Substitution of capital for labor in construction has not fully offset the rise in real wages, and housing prices have risen relative to other prices.

Our earlier discussion of housing prices makes clear that available data on housing prices combine the effects of changes in the size and quality of housing units, changes in the mix of housing produced and changes in the nominal price of a standardized housing unit. Without some means of separating the factors affecting housing prices, there is no way to use these data as a meaningful basis for any conclusion about the effects of technological change on housing. Nor can the data be used to support any generalization about the effect of labor union monopolies on the relative price of housing.

Our equations provide a basis for separating some of the factors affecting housing prices if we are willing to make some additional assumptions. Suppose that changes in the real wages of construction workers are entirely the result of changes in the productivity of labor in the construction industry and increases in the monopoly power of construction unions or, more generally, of workers engaged in home building. We assume that all real wage increases resulting from any increased monopoly power of construction workers increase the price of housing units relative to the prices of other goods and services. Finally, we assume that all increases in the productivity of labor in homebuilding either increase the quality or reduce the price of houses relative to the prices of other goods and services. Homebuilding is a relatively competitive industry with many builders in most locations and some builders in
many different locations. Entry, exit and re-entry are relatively common. Hence it is not unreasonable to believe that our assumptions are met, at least approximately, in practice.

Our equations imply that a 1 percent increase in the real wage of construction workers has much less effect on housing starts and rental prices than on the index of housing prices. Equilibrium housing starts decline 0.06 percent and rental prices rise 0.13 percent with each percentage point increase in real wages. Housing prices increase by 1.45 percent.

During the postwar years 1947 to 1968, the GNP deflator rose 62 percent and measured productivity per manhour in the private, non-farm sector rose 80 percent. If productivity in homebuilding increased at the average rate of increase, increased productivity raised $p_h$ by 1.16 percent ($0.80 \times 1.45$). If the increase in the GNP deflator raised $p_h$ by the same percentage as other prices, $p_h$ would have increased by 178 percent during the period as a result of price and productivity changes alone. The actual increase is 120 percent, considerably less than the computed increase. On these assumptions, there is no room for an effect of increased monopoly power on housing prices during this period. To obtain some effect, we must assume either that productivity increases much less rapidly in home construction than the average for all private non-farm economic activity. Moreover, the calculation leaves no room for the increase in the monopoly power of construction union resulting from an increased role of government and the effect of Davis-Bacon regulations.

We cannot push the calculation beyond the point we have reached. We can, however, estimate the effect of reduced monopoly power on home building. Suppose that after eliminating Davis-Bacon the real wages of construction workers fall by 5 percent. The reduction adds approximately 0.3 percent to the equilibrium number of housing starts, 6,000 units at current rates of production. The change would be a once-and-for-all increase in the rate of production. To obtain an equal increase the following year requires a further reduction in the real wages of construction workers.

IV. CONCLUSION

Many countries have adopted policies of regulating credit markets to increase the amount of mortgages offered at prevailing interest rates. In the U.S., a number of government intermediaries are now empowered to sell insured or guaranteed bonds and purchase mortgages. Controls on interest rates at banks and thrift institutions, under Regulation Q, are often defended as a means of maintaining or increasing the liabilities of the institutions that buy mortgages during periods of rising interest rates.

A main reason for control and regulation is the belief that lack of availability of mortgage credit limits the production of housing. There is no lack of evidence showing that the stock of mortgage credit and the number of housing starts are positively related and that both are negatively related to interest rates. However, there is little if any evidence that the relationships are the result of a process run-
Economic theory offers an alternative explanation of the observed correlations. Housing is a durable asset. Rising interest rates induce postponement of durable purchases, including housing purchases, and falling interest rates accelerate purchases. Rising interest rates on open market securities increase net withdrawals from thrift institutions, where deposit rates generally change slowly, and falling open market rates increase net deposits.

The two explanations have very different policy implications. One suggests that policies that increase the amount of mortgage credit increase the demand for housing; the alternative view suggests that desired mortgage borrowing increases and decreases in response to changes in the demand for housing and the relative costs of debt and equity invested in housing. Attempts to increase the amount of mortgage credit have little or no effect on the amount of housing demanded or supplied, if the alternative explanation is correct.

The data reject the conventional view. We find no evidence that the demand for or supply of housing increases with changes in the stock or flow of mortgage credit. On the contrary, the evidence suggests that attempts to increase housing purchases or production by increasing mortgage credit have little effect. Our use of annual data may, of course, hide some short-period relationship. Without further study nothing can be said.

The absence of a clear, positive relation between the stock or flow of mortgage credit and the demand for housing has implications for monetary theory and the practice of monetary policy. The notion that the composition of credit is a determinant of output or the composition of output is very old. In the nineteenth century, this view was associated with the group known as the “Banking School.” In the twentieth century, advocates of the flow-of-funds approach to monetary analysis have shown considerable interest in the composition of credit. Our failure to find any significant influence of credit on demand in the market where credit flows and stocks are regarded as most important tends to cast doubt on the conjectures of the economists who make these arguments.

The conclusions of our analysis are based on a three equation model of the demand for housing services, the demand for housing and the supply of housing. Our empirical estimates suggest that the principal determinants of the housing equations are relative prices, interest rates, income and real wealth. The demand and supply equations for housing are relatively interest-elastic. These findings seem consistent with broad movements in housing over time and during cycles.

Our findings suggest that in a stable, growing economy the number of housing starts increases faster than population. Less clear, but still persuasive, evidence suggests that the size and quality of housing units also increases relative to population. The implication of these findings is that a policy of steady growth without inflation increases the aggregate stock of housing per capita. There is no evidence of a long-run housing “problem,” nor is there evidence that mortgage or housing policies are required to encourage production or purchases.
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