THE RELATIONSHIP BETWEEN HOUSING STARTS AND MORTGAGE AVAILABILITY

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Abstract—Sims' innovation-accounting techniques are used to investigate the relationship between housing starts and mortgage availability using U.S. monthly data over 1967–1984. First, a four variable vector autoregression is employed to compute impulse response functions. The results suggest that housing starts are significantly influenced by both interest rates and mortgage availability. Second, the estimated vector autoregression is used to compute a historical decomposition of the starts series using 1979(12) as the base period. The decomposition suggests that deregulation and the evolution of more competitive financial markets has led to a significant weakening of availability effects.

I. Introduction

This paper presents an empirical analysis of the relationship between housing starts and mortgage availability using U.S. monthly data over 1967–1984. The principal motivation for the paper arises from the observation that the use of credit availability variables to explain variations in residential investment has been a topic of considerable controversy in the housing market literature. Although it is relatively common for housing sector models to include availability as an independent constraint on construction activity, there appears to be little consensus on how to model availability effects and on their significance in determining residential investment.

Support for the availability hypothesis can be found in several studies. Jaffe and Rosen (1979), using quarterly U.S. data over 1965–1978, for example, report a significant relationship between deposit flows into lending institutions and housing starts: "...we find that cyclical fluctuations in home building continue to be determined largely by the pattern of deposit flows into thrift institutions" (1979, p. 374).

Arceus and Melzer (1973) suggest an alternative explanation of the role played by mortgage availability in the housing market. The essence of this approach is that any observed correlation between mortgage availability and residential investment is the result of two separate, and independent, effects. First, if interest rates at thrift institutions are slow to adjust, rising capital market rates lead to the process of disintermediation by providing an incentive for the public to shift from deposits at financial institutions to marketable securities. Second, rising capital market rates also induce households to postpone the purchase of durable assets such as housing. The total effect is that both mortgage availability and housing activity may fall (rise) during periods when capital market rates are increasing (decreasing) more rapidly than rates at thrift institutions but any observed decline in housing starts during periods of disintermediation is, ceteris paribus, due to a shift in the demand for housing rather than a cutback in mortgage supply.

Further evidence against the availability hypothesis is provided by Karel and Mishkin (1977) who, like Jaffe and Rosen, use U.S. quarterly data to estimate single equation models for housing starts and conclude that "tests of credit rationing effects on housing demand pursued here do not resolve the controversy over whether these effects do indeed exist. On the other hand, plots of the actual value of single and multiple family housing starts and the fitted values...indicate that the availability doctrine is by no means needed to explain the postwar residential housing cycle" (1977, p. 1582).

The substantive issue dividing these alternative explanations of the relation between the housing and mortgage markets is whether mortgage availability acts as an independent constraint on residential construction activity. That is, controlling for the influence of interest rates, is there evidence of a causal relationship running from the supply of mortgage credit to the level of housing starts? The present paper attempts to make a contribution to this debate by applying Sims' (1980) innovation-accounting techniques to monthly U.S. data on housing starts and mortgage availability over the period 1967(6)–1984(3). An unrestricted model consisting of observations on private sector starts, mortgage availability, the mortgage interest rate and the average interest rate on long-term government bonds is estimated as a vector autoregression (VAR). The moving average representation of the VAR is then used to undertake two innovation accounting exercises. These are estimation of the impulse response functions (IRFs) and historical decomposition of the starts series since 1980(1). The second exercise is specifically designed to judge the relative importance of availability and interest rates in explaining housing starts since the introduction of financial deregulation in 1980. Section II outlines the technique used, the results are discussed in section III and conclusions are presented in section IV.

Received for publication June 12, 1984. Revision accepted for publication January 18, 1985.

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Most of this paper was written while the author was visiting the Department of Economics, McMaster University, Hamilton, Ontario. The author also wishes to express his gratitude to the Committee for Social Science Research in Ireland for financial support. Thanks are also due to John Burbidge, Paddy Geary and two anonymous referees for comments on an earlier draft. The usual disclaimer applies.

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II. Innovation Accounting

To illustrate the particular technique employed consider the following VAR system:

\[ H(L) y_t = u_t \]  \hspace{1cm} (1)

where \( y_t \) is an \( n \times 1 \) vector of endogenous variables, \( u_t \) is an \( n \times 1 \) vector of white noise processes and \( H(L) \) is an \( n \times n \) matrix of polynomials in the backward shift operator \( L \). If \( H(L) \) is normalised so that the first entry of each polynomial in the diagonal is unity then converting (1) to the moving average representation gives

\[ y_t = \left( H(L) \right)^{-1} u_t = \sum_{i=0}^{\infty} c_i u_{t-i} \]  \hspace{1cm} (2)

where \( c_0 \) is an identity matrix. The vector \( u_t \) is given by

\[ u_t = St_t \]  \hspace{1cm} (3)

where \( v_t \) is a vector of orthogonal random variables such that \( Ev_t = I \), and the matrix \( S \) is defined by \( SS' = I \), the covariance matrix of \( u_t \). Although there is more than one factorization of the covariance matrix \( \Sigma \) into \( SS' \) the computation method uses the Choleski decomposition in which \( S \) is lower triangular. The moving average representation, equation (2), may therefore be expressed in terms of orthogonalised innovations,

\[ y_t = \sum_{i=0}^{\infty} c_i S v_{t-i} \]  \hspace{1cm} (4)

where the columns of \( c_i S \) give the impulse responses of each \( y \) at time \( t+j \) to a shock in the orthogonalised innovations at time \( t \). If a one-period shock is administered to the \( j^{th} \) component of \( v_t \) such that \( v(j)_t \) is unity then the response of \( y(j) \) is also unity and the response of \( y(j,1) \) is given by the \( j^{th} \) column of \( c_i S \). Computing the IRFs therefore presents a picture of the system's reaction to shocks in a selected variable.

The historical decomposition is computed by first selecting a base period \( T \) and expressing \( y_{T+j} \) as

\[ y_{T+j} = \sum_{i=0}^{j-1} c_i S v_{T+j-i} + \sum_{i=j}^{\infty} c_i S v_{T+j-i}, \hspace{1cm} j = 1, 2, \ldots \]  \hspace{1cm} (5)

where \( T+j \) is less than or equal to the last period in the sample. The first term in (5) represents that part of each variable which is due to innovations since \( T \), while the second is a base projection formed from the information available at time \( T \). The importance of availability in determining starts since period \( T \) may therefore be judged from the extent to which the former's innovations narrow the gap between the base projection of starts and the actual series. In the estimates presented below \( T \) is set at 1979Q12, just prior to the deregulation program. A priori we might expect that the development of a more competitive financial environment should be associated with a gradual diminishing of the disintermediation process and hence with a decline in the significance of availability effects.

III. Estimation and Results

The relation between housing starts and mortgage availability, the \( y \) vector, is defined as

\[ y' = (GBR, MIR, AVL, STS) \]  \hspace{1cm} (6)

where \( GBR \) is the average interest rate on long-term government bonds, \( MIR \) is the interest rate on new home mortgages, \( AVL \) is mortgage availability and \( STS \) is the number of privately-owned housing starts. A full description of the data and sources is given in the appendix.

The government bond rate is used as a proxy for capital market rates and is included in (6) for reasons suggested earlier. The mortgage rate is also included in (6) for similar reasons. If, as is likely, the mortgage rate has a direct influence on both starts and availability then failure to control for its influence might lead to the conclusion that starts and availability are significantly related when, in fact, they are not.

Mortgage availability is defined as the change in real deposit flows through Savings and Loan Associations and Mutual Savings Banks; that is, if \( DP \) is the nominal deposit stock and \( PH \) is the average price of new houses then \( AVL_t = \Delta (DP_t/PH_t) \). Although this definition of availability is restrictive in the sense that it excludes other mortgage lenders such as insurance companies, commercial banks and federal agencies, its use can be defended on two grounds. First, it is a good indicator of disintermediation out of thrift institutions, which is generally considered to be a primary factor underlying the cyclical behaviour of mortgage rationing. Second, we can be fairly confident that the data are reflecting changes in mortgage supply and not in mortgage demand. Other variables such as actual commitments or net mortgage stock changes are inappropriate availability measures because we cannot be sure that the observations on them reflect shifts in either supply or demand or both; that is, these variables may reflect phenomena on both sides of the mortgage market whereas deposit flows measure supply side changes only.

\(^1\) The RATS time series package was used for all computations. See Doan and Litterman (1981).

\(^2\) The use of orthogonalised innovations implies assigning contemporaneous correlations among the variables.

\(^3\) See Doan and Litterman (1981), 11.
A. Impulse Response Functions (IRFs)

The VAR was estimated using monthly data over 1967(6)–1984(3). The number of lags was set at four and a constant, trend and eleven seasonal dummies were included as deterministic components. The responses of each variable were then scaled by the standard deviation of its own innovations. This scaling was undertaken in order to gauge the size of the responses relative to what is “normal” for each variable. Hence the contemporaneous response of starts to a shock in the government bond rate, for example, is equal to 8% of the standard deviation of the former’s own innovations. To judge the significance of the responses their absolute values were compared to the standard errors of the posterior distribution of orthogonalised responses.

The IRFs indicate that housing starts exhibit significant and persistent responses to shocks in interest rates and mortgage availability. The responses to an availability shock are slightly less significant, in relation to their standard errors, and of a smaller magnitude than are the responses to interest rate shocks. Nevertheless, the data clearly indicate that mortgage availability does play an independent and significant role in explaining housing starts. Further, the responses of the mortgage interest rate to a shock in the government bond rate are also consistent with the availability hypothesis. For example, twelve periods after the shock to GBR the response of the mortgage rate is still greater than the standard deviation of its own innovations and is more than double the computed standard error of the response, thus indicating sluggish adjustment to market imbalances. Hence the IRFs appear to be more consistent with the results reported by Jaffee and Rosen (1979) than with those suggested by Arcelus and Meltzer (1975). That is, housing starts are influenced by variations in both interest rates and availability, and the mortgage rate appears to exhibit sluggish responses to shocks in capital market rates.

B. Historical Decomposition

To gauge the possible impact of deregulation the moving average representation of the VAR was used to compute a historical decomposition of the starts series with 1979(12) as the base period. Figures 1A and 1B illustrate these decompositions. In each case the solid line gives the actual starts series over 1980(1) to 1984(3). The dashed lines illustrate a base projection of starts, or the forecast based on information available at the end of 1979. From equation (3) it is clear that the difference between the actual series and the base projection is due to the innovations in all variables since 1980(1), so that the importance of any one variable can be judged by the extent to which its innovations close the gap between

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**Table 1. Impulse Response Functions**

<table>
<thead>
<tr>
<th>Impulse Variable</th>
<th>Response Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>GBR</td>
<td>GBR</td>
<td>1.00b</td>
<td>1.01b</td>
<td>0.97b</td>
<td>0.81b</td>
<td>0.79b</td>
<td>0.78b</td>
<td>0.60b</td>
</tr>
<tr>
<td>MIR</td>
<td>GBR</td>
<td>0.07a</td>
<td>0.57b</td>
<td>1.11b</td>
<td>1.47b</td>
<td>1.44b</td>
<td>1.40b</td>
<td>1.37b</td>
</tr>
<tr>
<td>AVL</td>
<td>GBR</td>
<td>0.08a</td>
<td>0.10a</td>
<td>-0.01</td>
<td>-0.20b</td>
<td>-0.05</td>
<td>-0.15b</td>
<td>0.00</td>
</tr>
<tr>
<td>STS</td>
<td>GBR</td>
<td>-0.08a</td>
<td>-0.18a</td>
<td>-0.28b</td>
<td>-0.43b</td>
<td>-0.44b</td>
<td>-0.47b</td>
<td>-0.38b</td>
</tr>
</tbody>
</table>

| MIR              | GBR               | 0.00  | 0.07a | 0.15a | 0.15a | 0.15a | 0.15a | 0.17a |
| MIR              | MIR               | 1.00b | 0.81b | 0.95b | 0.86b | 0.92b | 0.91b | 0.79b |
| AVL              | MIR               | 0.03  | 0.13a | -0.20b| -0.13b| 0.11a | -0.07a| 0.02a |
| STS              | MIR               | -0.19b| -0.15a| -0.16a| -0.24b| -0.23a| -0.25a| -0.18a|

| AVL              | GRR               | 0.00  | 0.05  | -0.05 | 0.01  | -0.08 | -0.07 | -0.05 |
| MIR              | GRR               | 0.00  | -0.05 | -0.08a| -0.31b| -0.35b| -0.31a| -0.26a|
| AVL              | GRR               | 1.00b | -0.53b| 0.11a | -0.02 | -0.17a| 0.22b | 0.00  |
| STS              | GRR               | 0.09a | 0.14a | 0.18b | 0.20b | 0.20a | 0.18b | 0.13a |

| STS              | GBR               | 0.00  | 0.12a | 0.04  | 0.00  | 0.01  | 0.02  | 0.07  |
| MIR              | GBR               | 0.00  | -0.16b| -0.16a| -0.07 | -0.08 | -0.08 | 0.13  |
| AVL              | GBR               | 0.00  | 0.03  | -0.01 | 0.00  | 0.06  | -0.02 | 0.00  |
| STS              | GBR               | 1.00b | 0.60a | 0.59b | 0.62b | 0.52b | 0.50b | 0.25a |

*The response is greater than, but less than double, the estimated standard error.

The response is more than double the estimated standard error.

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4 A series of likelihood ratio tests starting at six lags accepted restrictions to four lags.

5 The standard errors were computed by taking 100 draws from the posterior distribution.
the actual series and the base projection. The dotted line in figure 1A shows the base projection plus the effect of government bond rate innovations since 1979(12). Similarly, in figure 1B the dotted line illustrates the projection plus the influence of availability innovations.

For the first eighteen months the base projection and the actual starts series move together, but begin to diverge significantly around the middle of 1981. Beyond that point the base plus interest rate projection, figure 1A, tracks the actual series quite closely indicating that interest rate innovations continue to play a significant role in explaining the observed behaviour of housing starts. By contrast, in figure 1B it is difficult to distinguish between the base projection and the base plus availability projection. That is, the influence of availability, relative to that of interest rates, appears to be considerably weaker during the period of deregulation.

IV. Conclusions

The principal objective of this paper was to provide empirical evidence on the relation between housing starts and mortgage availability. The results of the innovation-accounting exercises reported in section III suggest that there is some evidence of an independent effect running from variations in availability to starts. However, it is clear that mortgage availability is by no means the dominant influence on housing starts and that its role is not greater than that played by interest rates. The evidence therefore rejects the position of Arcelus and Meltzer (1973) who claim that availability plays no role in explaining starts, and concurs with the conclusions of Jaffee and Rosen (1979) who suggest that deposit flows through institutions are, along with interest rates, a major determinant of fluctuations in home building. Finally, the historical decomposition suggests that deregulation and the evolution of more competitive financial markets has led to a significant weakening of availability effects.

DATA APPENDIX

Housing Starts, STS = the number of privately-owned housing starts. Source: Business Statistics, Dept. of Commerce, Bureau of Economic Analysis (various issues).

Mortgage Availability, AVL = \( \Delta (DP/IPH) \). DP is the stock of deposit liabilities at Savings and Loan Associations and Mutual Savings Banks (\( \text{'m} \)); PH = average purchase price of new homes (\( \text{'000} \)). Source: Federal Reserve Bulletin (various issues).

Mortgage Interest Rate, MIR = interest rate on mortgages on new homes.\(^1\) Source: Federal Reserve Bulletin (various issues).

Government Bond Rate, GBR = Average yield on long-term government bonds. Source: Federal Reserve Bulletin (various issues).

\(^1\) Both PH and MIR were taken from the FRB table Mortgage Markets, Terms on Conventional Mortgages on New Homes.

REFERENCES


