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THE RELATIONSHIP BETWEEN HOUSING STARTS AND MORTGAGE AVAILABILITY

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The Relationship Between Housing Starts and Mortgage Availability

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1. Introduction

This paper presents an empirical analysis of the relationship between housing starts and mortgage availability using United States monthly data over 1967 to 1979. 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.

The usual justification for emphasizing availability effects in the housing market rests on the assumption that mortgage interest rates are sluggish in the sense that they adjust slowly to market pressures. When capital and money market rates are rising, for example, mortgage lending institutions such as Savings and Loan Associations and Mutual Savings Banks may be slow to adjust their interest rate structure to competitive, or market clearing, levels. Failure to offer competitive rates on liabilities leads to the process of disintermediation and, as mortgage lending is closely related to the flow of savings through these institutions, to an excess demand for mortgage finance. As mortgage demand is a derived relationship linked to the underlying demand for housing the resulting cut back in supply acts as a constraint on housing activity. Given that the observed mortgage flow equals the minimum of demand/supply, an interest rate below the market clearing level implies that the actual mortgage flow is given by the supply curve and will be insufficient to finance the level of housing activity desired at the observed interest rate. It follows that a ceteris paribus rise in mortgage availability will stimulate housing activity without any adjustment to the mortgage interest rate providing the latter is below its market clearing level.

Empirical support, derived from regression analysis, for the availability hypothesis can be found in several studies. Jaffee and Rosen (1979), using quarterly U.S. data over 1965 to 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." (1974, p. 374) Whitehead (1974) and Mayes (1977) find similar relationships in U.K. quarterly data and Smith (1970) reports a significant relationship between Canadian housing starts and availability variables.

Arcelus and Meltzer (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, given that interest rates at thrift institutions are slow to adjust then rising capital market rates lead to the process of disintermediation outlined above. Second, in addition to providing an incentive for the public to shift from deposits at financial insitutions to marketable securities, 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 rise (fall) 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 cut back in mortgage supply.

In support of this approach Arcelus and Meltzer estimate an annual model of U.S. starts and report that: "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 [of a government agency purchasing one per cent of the existing mortgage stock]...we could choose zero." (1973, p. 95) Further evidence against the availability hypothesis is provided by Kearl and Mishkin (1977) who, like Jaffee 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." (1972, p. 1582) [1]

The substantive issue dividing these alternative explanations of the relation between the housing and mortgage markets is whether or not 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's (1980) innovation-accounting techniques to monthly United States data on housing starts and mortgage availability over the period 1967(1) to 1979(12).[2] 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 types of innovation-accounting exercises. First the forecast error variances are decomposed into proportions attributable to each variables' innovations and the resulting variance decomposition is used as a guide to the exogeneity of each variable in the system. Second, the moving average representation is used to trace out the impulse responses of the system to one period shocks in each variable. The responses of housing starts may then be taken as indication of the strength and direction of the manner in which residential construction reacts to shocks in interest rates and mortgage availability.

2. Innovation Accounting

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

$$H(L)y_t = u_t \qquad (1)$$

where y is an nx1 vector of endogenous variables, u is an nx1 vector of white noise processes and H(L) is an nxn matrix of polynominals in the backward shift operator L. If H(L) is normalised so that the first entry of each polynominal in the diagonal is unity then converting (1) to the moving average representation gives,

$$y_t = [H(L)]^{-1}u_t = \sum_0^{\infty} c_i u_{t-i} \qquad (2)$$

where c_0 is an identity matrix. The vector u_t is given by,

$$u_t = Sv_t \qquad (3)$$

where v_t is a vector of orthogonal random variables such that $Evv' = I$, and the matrix S is defined by $SS' = \Gamma$, the covariance matrix of u_t. Although there is more than one factorization of the covariance matrix Γ into SS' the computation method uses the Choleski decomposition in which S is lower triangular.[3] The moving average representation, equation (2), may therefore be re-expressed in terms of orthogonalised innovations. That is,

$$y_t = \sum_0^{\infty} c_i S v_{t-i} \qquad (4)$$

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 $y(j)_t$ is also unity and the response of $y(j)_{t+j}$ is given by the j^{th} column of $c_i S$. Computing the impulse responses therefore presents a picture of the system's reaction to shocks in a selected variable. If, for example, a shock to availability innovations produced significant positive responses in housing starts then the results may be taken as evidence supporting the mortgage availability hypothesis.

The variance decompostion may be obtained by assuming a zero value for $_tEu_{t+j}$, where $_tE$ is the expectation at time t, and expressing the k^{th} step-ahead forecast of the y's as,

$$\sum_{0}^{k-1} c_i u_{t+k-1} = \sum_{0}^{k-1} c_i S v_{t+k-1} \qquad (5)$$

which can be used to apportion the variances of the forecast errors among the n components of y. The greater the proportion of any variable's forecast error variance which can be explained by its own innovations the more likely it is that that variable should be treated as exogenous. Likewise if one variable is dominant in accounting for the forecast error variance in another variable then the former may exert a causal influence on the latter. The availability hypothesis therefore implies that a significant proportion of the forecast error variance of housing starts can be explained by availability innovations.

3. Estimation and Results

For the purpose of investigation the relation between housing starts and mortgage availability the y vector is defined as,

$$y' = (GBR, MIR, AVL, STS) \qquad (6)$$

where GBR is the average interest rate on long-term government bonds, MIR is the mortgage interest rate on new homes, AVL is mortgage availability and STS is the log of 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 outlined in the Introduction. 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. Further, tracing out MIR's responses to shocks in the other variables may shed some light on the manner in which the mortgage market reacts to demand (STS) and supply (GBR, AVL) shocks.

Mortgage availability is defined as the rate of change in deposit flows through Savings and Loan Associations and Mutual Savings Banks relative to the change in new house prices; that is, if DP is the nominal deposit stock and PH is the average price of new houses then $AVL_t = \Delta LnDP_t - \Delta LnPH_t$. 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 is 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.

An important decision in estimating VARs is the choice of lag length. Letting m be the number of lags and d be the deterministic components, the total number of coefficients to be estimated is given by $n(nm+d)$. Increasing m therefore leads to an increase in the number of coefficients and to a loss of degrees of freedom. The lag length was selected by performing a series of likelihood ratio tests for different values of m. Starting at m=6, the data accepted the restriction to m=5 and to m=4. Four lags were therefore used in the estimation. An additional problem arises in that the use of orthogonalised innovations implies assigning contemporaneous correlations among the variables in the system. That is, the order of the variables must be pre-selected so that the innovations of the first variable in the system influences all the others contemporaneously, while the second variable's innovations have a contemporaneous effect on all but the first etc. Intuitively it seems plausible to place GBR first in the order and, as the paper is primarily concerned with the responses of housing starts, to place STS last. The initial order chosen was (GBR, MIR, AVL, STS) which allows innovations in the government bond rate to affect the other variables contemporaneously, but permits the starts innovations only to influence STS contemporaneously. However, as the variance decomposition and impulse responses may be sensitive to the order used the results are, where appropriate, also reported for the reverse ordering (STS, AVL, MIR, GBR). In what follows the initial ordering is denoted as OA and the reverse as OB.

The VAR was estimated using monthly data over 1969 to 1979. The deterministic components used were a constant, trend and eleven seasonal dummies. Table 1 reports critical levels of F-statistics pertinent to testing the hypotheses that all lags on the right-hand-side variables are zero, where the critical level is the significance level at which the null hypothesis is just rejected. The critical levels given in Table 1 suggest that capital market rates, as proxied by GBR, have little influence on both availability and starts and that the AVL is more important in explaining STS than either of the interest rates. Results of F-tests may therefore be interpreted as giving tentative support to the availability hypothesis.

Both the variance decompositions and the impulse responses were computed over 48 steps. Tables 2 and 3 give the variance decompositions for the orderings OA and OB respectively. The first column gives the variable whose forecast error is decomposed, the second gives the step-ahead and the third gives the standard error of the forecast. A significant feature of these tables is that the relative importance of each variable in the system is not affected by the ordering used. Both GBR and AVL appear to be exogenous in the sense that their forecast error variances can be explained largely by their own innovations. Inspection of the start's decomposition shows that of the other variables in the system GBR has the greatest influence and AVL the least influence apart from MIR, a result more consistent with the Arcelus-Meltzer view than with the availability hypothesis. However, given that the starts innovations can explain approximately 50 per cent of the starts forecast error variance it is clear that none of the other variables has a dominant influence of housing starts.

To compute the impulse responses a shock equal to one standard deviation of the variable's own innovations was administered to each variable in the system and the responses of each variable were scaled by the standard deviation of its own innovations. The reaction of STS to an availability shock, for example, measures the response of starts, relative to the standard deviation of the STS innovations, to a one standard deviation shock in AVL innovations. Tables 4 and 5 summarize the impulse responses by giving the absolute values maximum responses together with the period in which they occur. As with the variance decomposition, the results do not appear to be sensitive to the ordering used.

The responses illustrated in Figures 1 and 2 are derived from the initial ordering OA. Figure 1 gives the responses of housing starts to shocks in each variable. To judge the significance of these responses a one-standard-error band, dashed lines, is also illustrated.[4] Figure 2 gives a similar illustration for the mortgage rate. The statistical significance of the start's responses to shocks in GBR and AVL appear to be broadly similar. In each case the response is within one standard deviation of zero after 20 months indicating some degree of persistence. However, in each case the maximum starts response is less than one-half of the standard deviation of its own innovations suggesting that neither set of variables has a strong impact on construction activity. The impulse responses therefore suggest that while mortgage availability plays a role in explaining housing starts, its influence is substantially weaker than would be suggested by some versions of the availability hypothesis.

The mortgage interest rate responses, Figure 2, also cast doubt on the importance of availability effects. Proponents of the availability hypothesis, such as Jaffee and Rosen (1979), cite sluggish interest rate adjustment as the key to explaining why availability operates as an independent constraint on residential investment. Consequently the hypothesis requires that the MIR responses be both relatively weak and delayed. Figure 2, on the other hand, suggests that while there is some sluggishness over the first two months, the MIR responses are both large and significant. For example the response of MIR to a shock in GBR is almost twice as great as the standard deviation of its own innovations after only six months and is nearly three times as great after one year. Likewise, the decline in the mortgage rate in response to an availability shock is both rapid and significant over the first six to ten months. The pattern of MIR responses to a shock in STS, on the other hand, is more consistent with the availability hypothesis with the maximum value occuring after twenty months. Comparing the MIR responses suggests that mortgage rate adjustment is asymmetrical in the sense that the response is more rapid in relation to 'supply-side' disturbances (GBR and AVL) then to 'demand-side' disturbances (STS). This result is plausible in that changes in capital market rates may have a much more immediate and obvious impact on thrift institutions then the emergence of a disequilibrium which is primarily related to a rightwards shift in the mortgage demand curve.

4. 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 3 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 no greater than that played by interest rates. The evidence therefore not only rejects the position of Arcelus and Meltzer (1973) who claim that availability plays no role in explaining starts, but also the conclusions of Jaffee and Rosen (1979) who suggest that deposit flows through thirft institutions are the major determinant of fluctuations in home building.

This result, although somewhat negative, may be nonetheless useful. Attempts at structural modeling of housing starts has failed to reach a consensus on the significance of availability effects. The approach taken in the present paper, on the other hand, considers co-movements in the two series by placing a minimum set of restrictions on the data. Rather than presenting a structural model of housing starts the paper merely presents evidence relating to the statistical and empirical significance of mortgage availability in explaining variations in housing starts. Consequently the results should, at best, be regarded as a guide to, rather than a substitute for, structural modeling. In this respect the evidence suggests that mortgage availability should not be expected to play a major role in a model designed to explain fluctuations in residential investment.

Table 1. Critical Levels of F-Statistics.

Dependent Variable	Right-Hand-Side Variable GBR	MIR	AVL	STS
GBR	*	.105	.781	.946
MIR	*	*	.012	.150
AVL	.480	.049	*	.923
STS	.389	.112	.067	*

Note, * indicates a value less then .01.

Table 2. Decomposition of Forecast Error Variances: Order, OA.

Variable	Step Ahead	Standard Error	% Due to Innovations in, GBR	MIR	AVL	STS
GBR	6	.407	91.1	7.7	0.9	0.3
	12	.517	81.6	15.9	2.2	0.3
	24	.629	75.9	19.5	2.5	2.1
	48	.654	73.3	19.4	2.3	5.0
MIR	6	.233	37.9	57.6	4.3	0.2
	12	.443	52.2	42.5	4.6	0.7
	24	.638	57.5	35.0	3.7	3.8
	48	.682	55.6	33.0	3.4	8.0
AVL	6	.031	3.0	4.0	92.5	0.5
	12	.031	3.5	4.0	91.8	0.7
	24	.031	3.6	4.0	91.7	0.7
	48	.031	3.7	4.1	91.5	0.7
STS	6	.152	8.7	3.8	8.3	79.2
	12	.204	23.1	6.7	9.8	60.4
	24	.240	33.8	7.9	10.0	48.3
	48	.242	34.6	8.0	9.9	47.5

Table 3. Decomposition of Forecast Error Variances: Order OB.

Variable	Step Ahead	Standard Error	% Due to Innovations in, STS	AVL	MIR	GBR
STS	6	.152	88.7	5.3	1.3	4.7
	12	.204	72.5	8.4	3.8	15.3
	24	.240	60.5	10.0	5.3	24.2
	48	.242	59.5	10.0	5.5	25.0
AVL	6	.031	1.6	92.6	3.8	2.0
	12	.021	1.6	91.9	3.9	2.6
	24	.031	1.7	91.8	3.9	2.6
	48	.031	1.7	91.7	4.0	2.6
MIR	6	.233	3.3	9.2	59.4	28.1
	12	.443	1.4	11.0	46.1	41.5
	24	.638	1.5	10.6	40.1	47.8
	48	.682	4.6	9.8	38.8	46.8
GBR	6	.407	1.7	3.7	9.2	85.4
	12	.517	1.4	6.5	18.5	74.1
	24	.629	1.4	7.6	23.2	67.8
	48	.654	3.4	7.4	23.6	65.6

Table 4. Maximum Responses: Order, OA*

Response of	To a Shock in,			
	GBR	MIR	AVL	STS
GBR	1.00	.27	-.11	.11
Period	01	08	10	24
MIR	2.60	1.99	-.74	.81
Period	12	09	10	20
AVL	-.14	-.19	1.00	.05
Period	01	04	01	02
STS	-.46	-.24	.35	1.00
Period	12	08	05	01

*Responses are scaled by the standard deviation of each variables innovations. The period given is the month in which the absolute value of the response is greatest.

Table 5. Maximum Responses: Order, OB*

Response of	To a Shock in STS	AVL	MIR	GBR
STS	1.00	.31	-.20	-.40
Period	01	05	11	12
AVL	.13	1.00	-.19	-.13
Period	01	01	04	03
MIR	.61	-1.15	2.11	2.39
Period	30	11	10	13
GBR	-.12	-.17	.28	1.00
Period	02	10	10	01

*Responses are scaled by the standard deviation of each variables innovation. The period given is the month in which the absolute value of the response i greatest.

Footnotes

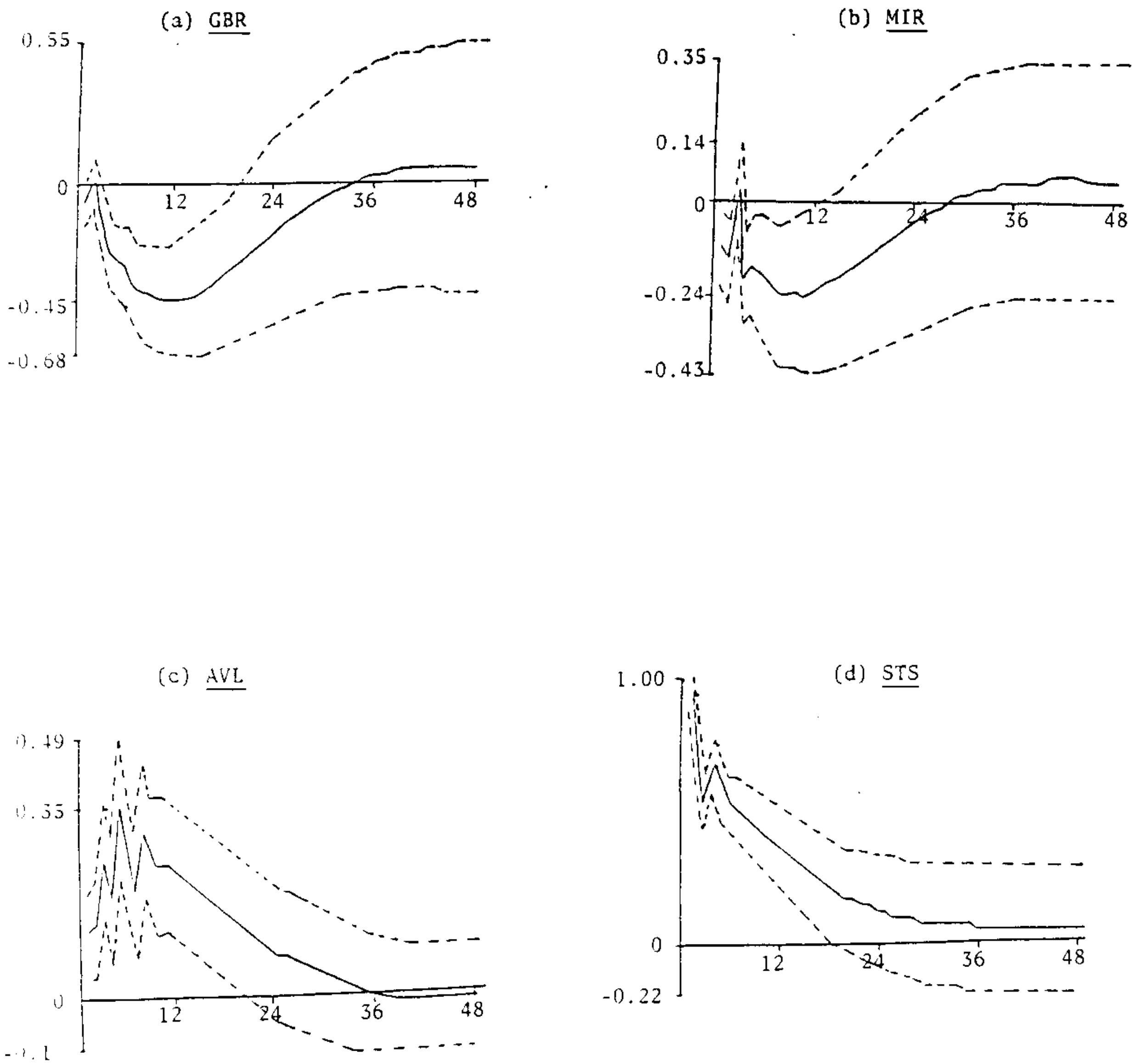
[1]Over the sample period the Federal Home Loan Board had the power to set interest rate ceilings on deposit liabilities of federally chartered Saving and Loan Associations. This control, rather than the sluggish response of thrift institutions may have been the major source of disintermediation. The sample is therefore terminated at 1979 (12) to exclude the relaxation of controls beginning in 1980.

[2]For further evidence for and against the availability hypothesis see, De Rosa (1978), Fair and Jaffee (1972) and Maddala and Forrest (1974).

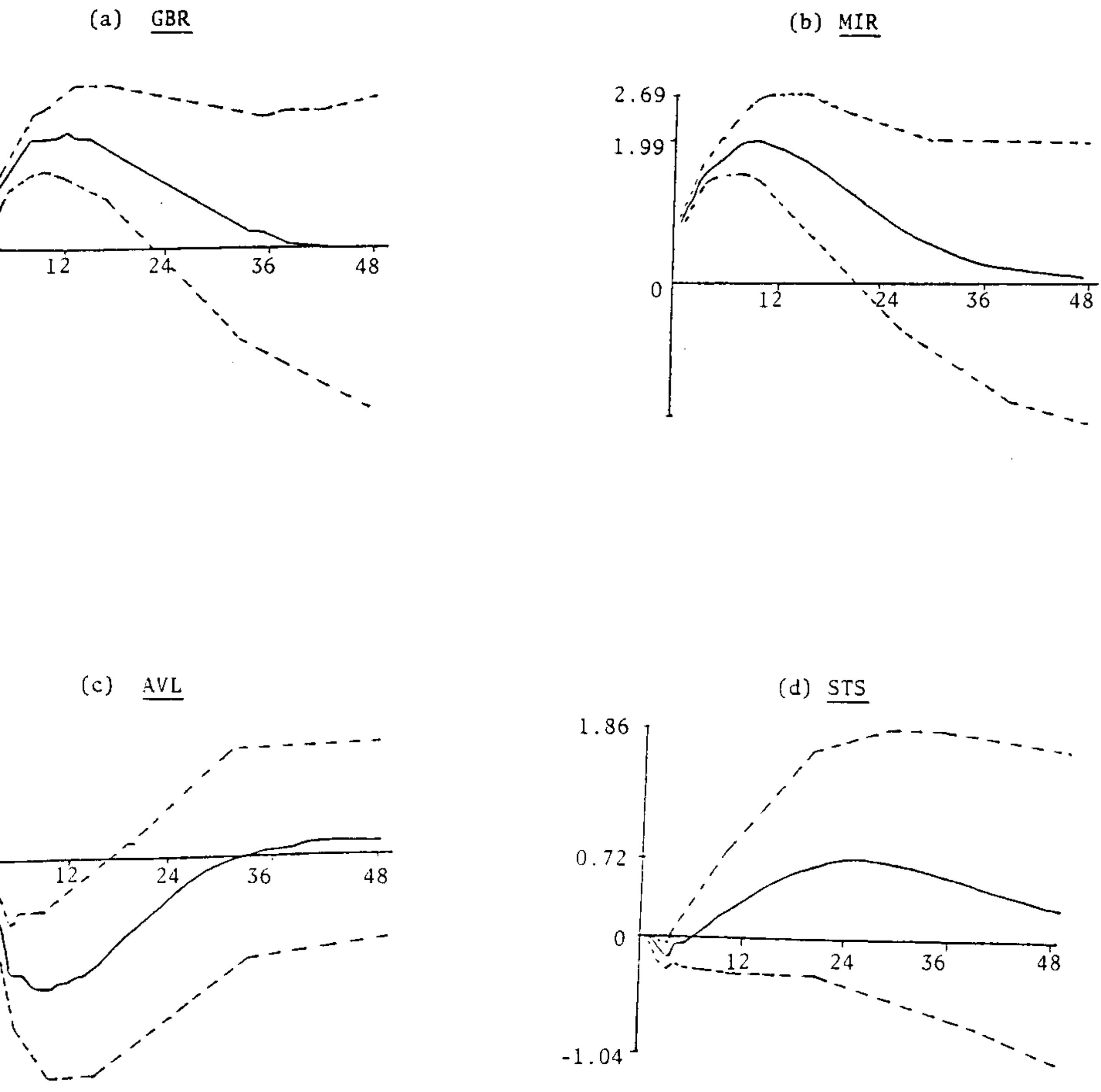
[3]The RATS time series package was used for all computations. See Doan and Litterman (1981).

[4]The standard errors were computed by taking 100 draws from the prosterier distribution. See Doan and Litterman (1981) Ch. 12.

Figure 1. Starts Responses to Shocks in,



2. Mortgage Rate Responses to Shocks in,



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Data Appendix:

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

Mortgage Availability $AVL=\Delta LnDP_t - \Delta LnPH_t$. DP is the stock of deposit liabilities at Saving and Loan Associations and Mutual Saving Bonds ($'m); PH=average purchase price of new homes ($'000). Source, Federal Reserve Bulletin (various issues).

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

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

*Both PH and MIR were taken from the FRB table Mortgage Markets, Terms on Conventional Mortgages on New Homes.