

SOME DETERMINANTS OF THE DEMAND
FOR RESIDENTIAL MORTGAGE
FUNDS

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SOME DETERMINANTS OF THE DEMAND FOR
RESIDENTIAL MORTGAGE FUNDS:
AN ABSTRACT

The demand for residential mortgage funds should depend not only on the contract rate but on all of the terms of the mortgage: the loan origination fees, the loan to value ratio, loan size and maturity. Other studies which have relied on Ordinary Least Squares estimates have found these nonrate terms to be insignificant. The nonrate terms are highly correlated and OLS estimates tend to have large variances in the presence of multicollinearity. By using Principal Components Regression, more stable estimates are obtained indicating that these terms are important. The terms are included in the model individually and are used to calculate the downpayment and monthly payment which are then included.

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I. Introduction

Studies of the demand for residential mortgages have tended to concentrate on the contract rate as the principal determinant of the demand for mortgage loans. While the interest rate is generally regarded as the price of funds in the mortgage market, it is only one of several loan terms that affect the cost and the desirability of a mortgage loan to the borrower. Loan origination fees, the loan to value ratio, loan size and maturity should all have an impact on mortgage loan demand.¹ The idea that the monthly payment and the downpayment help to determine the demand for mortgage funds has a great deal of intuitive appeal since these are the dollar "prices" of obtaining the house. The downpayment and the monthly payment can, themselves, be viewed as the price of mortgage funds or, alternatively, the terms of the mortgage which, together with the amount of the loan, determine the downpayment and monthly payment can be viewed as the price. In this paper both specifications of the "price" of mortgage funds will be used in alternative estimates of the demand for mortgage funds.

Past empirical studies which have attempted to include mortgage loan terms, other than the contract rate, have found no significant relationship between these terms and mortgage loan demand. Since previous research in the area has relied almost exclusively on ordinary least squares regression analysis, their findings may be more indicative of multicollinearity problems, rather than reflecting a lack of sensitivity on the part of the borrower to mortgage lending terms. Because many of the terms of the mortgage tend to be highly correlated, the use of any OLS procedure can result in unstable and

statistically insignificant coefficients for the terms. Therefore, in this paper, a model of the demand for residential mortgage funds will be constructed and estimated using a principal component regression (PCR) technique. As explained in a subsequent section of this paper, PCR estimates are more stable in the presence of multicollinearity and consequently should improve the estimation of the model.

Our investigation is initiated with a review of the previous literature on demand for mortgage funds in order to identify those variables that have been found to be the most important determinants of mortgage borrower behavior. In Section III the model and the variables included for estimation are described. While the specification of the model will reflect, in large part, the findings of previous research, particular attention will be directed at isolating the impact of mortgage loan terms on mortgage money demand. In Section IV the methodology used to estimate the model is explained and in Section V the results of the estimations are examined. Section VI presents in summary form the findings and conclusions of the paper.

II. Evidence from Previous Mortgage Market Studies

A review of the principal empirical studies in this area [1], [3], [4], [5], [8], [13], reveals that the approach most often used to model borrower behavior is to treat mortgage debt acquisition as a portfolio or stock adjustment process. The basic premise of these stock adjustment models is that the change in mortgage debt during a given period is a function of the difference between the desired level of mortgage debt and the actual level of mortgage indebtedness in the previous period. In notational form this relationship can be expressed as:

$$\Delta M = \lambda(M^* - M_{t-1})$$

where ΔM is the net mortgage flow, M^* and M_{t-1} are, respectively, the desired level of mortgages and the actual level of outstanding mortgage debt in the previous period, and λ is equal to the speed of adjustment coefficient which will have a value between zero and one.

The most important specification of the model is the desired level of mortgage indebtedness, M^* , which is typically written as a function of both mortgage loan terms and the demand for housing.

Recognizing that the demand for mortgage funds is, at least in part, a derived demand, most researchers have specified residential mortgage funds demand as a function of the desired level of the stock of owner occupied housing. Because the desired stock of housing is not directly observable, it is usually incorporated in statistical models as personal income, consumer wealth, outstanding installment debt, and various rent and cost of construction indices which would help to determine the desired stock of housing.

While the demand for real assets reflects a utility maximizing decision by households, economic theory does suggest that the institutional and financial arrangements that govern their acquisition should affect consumer spending decisions. Consequently, mortgage loan terms that affect the real cost and availability of mortgage funds are included in the mortgage demand equations. Although most studies of the mortgage market have found that variables which influence real asset portfolio decisions of consumers are important determinants of mortgage loan demand, empirical evidence on the linkages between mortgage demand and the non-price terms of the loan is tenuous at best.

Dhrymes and Taubman's research [1], which is part of a larger study of the savings and loan industry, found no evidence that the terms of the mortgage loan, other than the interest rate, have any independent effect on the demand for mortgage loans. Mortgage loan demand, however, proved to be highly responsive to small changes in mortgage interest rates. Meltzer [8], in reviewing these findings in conjunction with his own research, goes even further and concludes that non-price lending terms have little effect on either the demand for mortgages or the demand for housing. Meltzer hypothesizes that such borrower sensitivity to mortgage interest rates indicates that mortgage loans are substitutes for other types of long term debt finance, which implies very different causal relationships.

William Silber's [13] study of the portfolio behavior of different types of financial institutions contains similar results. Interest rates are the only statistically significant mortgage term in Silber's mortgage demand equations.

In Jaffee's extensive econometric study of the mortgage market [5], the demand for mortgages is specified as a function of new housing investment, the mortgage interest rate, the corporate bond rate, the ratio of mortgages to the existing housing stock, and new commitments. Although Jaffee admits that the demand for mortgage loans "will depend on non-rate terms of the contract, such as the maturity of the loan," he decides against their inclusion in his demand formulation, apparently because "these factors have generally not been found important in previous studies of mortgage demand . . ." ([5] p. 161).

David Huang's [3, 4] research, on the other hand, does support the contention that non-price lending terms are important. Estimating separate demand equations for different types of mortgage loans (V.A., FHA, and conventional), Huang's results indicate that, at least for some of the equations, non-price lending terms and a composite credit availability variable, are statistically significant and correctly signed.²

On balance, however, these previous studies do not indicate that any systematic relationship exists between the non-price terms of the mortgage and the demand for mortgage loans.³

III. The Model

In our model, as in the studies which were just reviewed, the demand for mortgage funds is a function of the cost of mortgage funds as well as the factors which effect the demand for housing from which the demand for mortgage funds is derived. The cost of homeownership, the cost of alternative housing arrangements, the value of the house as an inflation shelter, the income of the purchaser and the already existing burden of debt should all have an impact on the demand for mortgage funds. Two different formulations of the model are estimated. All of the data used are monthly observations for the years 1973 to 1978. These years were chosen on the basis of data availability.

$$\Delta M = f(ER, LTV, AMT, MAT, PYC, CDPY, PCPHO, PCPR, SHELT, HH, T, M_{t-1}) \quad (1)$$

$$\Delta M = f(DP, PAY, PYC, CDPY, PCPHO, PCPR, SHELT, HH, T, M_{t-1}) \quad (2)$$

In both equations the dependent variable is the change in mortgages outstanding on the balance sheet of savings and loan associations. The

terms of the mortgage are included in two ways. In the first equation the individual terms - the effective rate (ER), the loan to value ratio (LTV), the amount of the loan (AMT), and the maturity (MAT) are included. In the second equation the downpayment (DP) and the monthly payment (PAY) which the terms imply are calculated and used in the model. By including all of the terms of the loan either individually or transformed into downpayments and monthly payments all of the characteristics of the mortgage loan which affect the demand for mortgage funds are taken into consideration.

As credit conditions tighten all of the characteristics of the mortgage loans will change. The effective rate will rise as both the contract rate and the loan initiation fees and charges increase. The size of the loans that lenders are willing to make both in percentage terms and in absolute terms will decrease so that the loan to value ratio (LTV) and the amount of the loan (AMT) will fall. The average maturity of the loans will also decrease. All of these will tend to make mortgage lending more expensive and will thus decrease the demand for mortgage funds.

Alternatively we can look at the effect of these changes in the terms on the downpayment and the monthly payment. As mortgage conditions tighten the changes in the terms of the mortgage loans will imply both higher downpayment (DP) and higher monthly payments (MPAY). As the initial cost of getting into a house increases and the monthly cost of remaining there also increases, some marginal homebuyers will be forced out of the housing market and the quantity of mortgage funds demanded will fall.

The income and wealth of the buyer should also have an impact on his demand for mortgage funds. Personal income in current dollars (PYC) is used to measure household's income. As income increases the demand for

houses and thus the demand for mortgage funds should increase. Consumer debt as a percentage of personal income (CDPY) is used to measure the already existing debt burden. As the burden of consumer debt increases, households are less likely to add the additional debt of a mortgage.

Three price variables are included: the percentage change in the cost of home ownership component of the Consumer Price Index (PCPHO), the percentage change in the rent component of the CPI (PCPR), and the difference between the percentage change in the homeownership component and the percentage change in the CPI (SHELT). The percentage change in the homeownership component of the Consumer Price Index (PCPHO) represents the change in the cost of owning a home. This includes not only the cost of buying the house but also maintenance costs, insurance, and all other costs of having a home. As the cost of home ownership increases, the demand for mortgage funds to purchase homes should decrease. The alternative to buying is renting; therefore, the percentage change in the rent component of the CPI (PCPR) is used to represent the cost of alternative housing arrangements. As the rental component increases, the demand for mortgage funds should increase since home ownership is more attractive. The difference between the percentage change in the homeownership component and the percentage change in the CPI (SHELT) is used to represent the hedge against inflation that buying a house offers to consumers. If the price of houses rises more rapidly than the general level of prices, then homeownership offers a hedge against inflation and the demand for mortgages to purchase houses should increase.

The demand for all forms of housing will be dependent on the number of households (HH). As the number of households increases the demand for

all types of housing will increase and the demand for mortgage funds will also increase. Because the dollar value of mortgages outstanding and hence the change in mortgages (ΔM) has trended upwards over the period 1973 to 1978, a time trend variable is included in the model. The lagged stock of mortgages (M_{t-1}) is also included in the model. The coefficient of this variable is the speed of adjustment coefficient.

IV. Methodology

A major problem of estimating this model and indeed a major problem in working with financial and economic data in general is the problem of multicollinearity. Examination of the correlation matrix of the explanatory variables, as well as the latent vectors and roots of that matrix, indicate that the variables are significantly correlated.⁴ If an ordinary least squares regression technique is used when multicollinearity is present, the resulting estimates will be unbiased, but the estimated variances will be very large, causing some variables which have a significant relationship with the dependent variables to appear to be insignificant. The resulting estimates will also be very unstable. Thus, researchers, in building their models, are faced with a difficult choice. They are specify the model in the form which they feel is theoretically correct and accept the fact that their results appear to be insignificant, or they can eliminate some of the variables which are collinear and introduce a misspecification bias in their results. A third alternative is the use of a principal component regression (PCR) technique. Principal component estimates are biased; however, the estimates will be more stable and the variance of the estimates will be smaller than the variance of the OLS estimates.⁵

Principal component regression transforms the independent variables into an equal number of components which are linear combinations of the independent variables. The components are formed by the multiplication of the matrix of the latent vectors of the correlation matrix and the matrix of the standardized independent variables. By eliminating the components which are involved in the multicollinearity, PCR removes the effect of that problem while retaining at least parts of all the variables. Once the coefficients for the components are estimated, it is possible to solve back to the coefficients of the independent variables.

In an operational context, the procedure consists of ascertaining which components to delete. This determination is based upon the specification of a critical value for the latent roots of the correlation matrix. Components associated with latent roots below the critical value (whose estimated coefficients have the highest variance) are deleted. The critical value chosen, therefore, should be large enough to eliminate the multicollinearity problem, yet small enough to minimize the bias resulting from omitted components.⁶

V. The Results

The results of the estimation procedure are contained in Table 1. Both formulations of the model explain a significant amount of the variation in the dependent variable; however, Equation One, which included the specific terms of the mortgage, fits the data somewhat better than Equation Two, which includes the down payment and the monthly payment.

Looking at the individual coefficients in Equation One, three of the four terms of the mortgage are significantly different from zero, and have

TABLE 1
REGRESSION RESULTS

| | Equation 1 | Equation 2 |
|--------------------------------|---------------------|---------------------|
| Adjusted R ² (F) | .735461 (33.436) | .629069 (20.786) |
| ER | -1945.85* | |
| LTV | 74.7562 | |
| AMT | 61.4398* | |
| MAT | 424.419* | |
| DP | | -441.391* |
| PAY | | - 18.5699* |
| PYC | 1.83129* | 3.44725* |
| CDPY | - 379.757* | -381.048* |
| PCPHO | - 108.407* | 43.9857 |
| PCPR | - 267.836* | -334.634* |
| SHELT | 6.4464 | - 51.7578 |
| HH | .175155* | .479434* |
| TIME | 19.4116* | 31.6307* |
| M _{t-1} | .006984* | .0176072* |

*Starred coefficients are significant at the .05 confidence level.

the expected sign. As the effective rate falls (mortgage funds are less expensive), the demand for mortgage financing should increase. This is confirmed by the negative and significant coefficient of the effective rate. If credit conditions ease and lenders are willing to make larger loans with longer maturities, the demand for mortgage funds should increase. The coefficients of the loan amount and the maturity are both significant and positive, as expected. Although the coefficient of the loan to value ratio has the expected positive sign (if lenders are willing to supply a larger percentage of the required funds the demand for mortgage funds will increase), it does not enter the equation significantly.

As expected, when personal income rises, the demand for mortgage funds increases. If the burden of debt increases, that is, consumer debt as a percentage of personal income rises, then mortgage demand should decrease. The coefficients of both these variables have the expected sign and are significant.

Two of the three price variables are significant. As the cost of home ownership increases (PCPHO) rises, the demand for mortgage funds should fall. The negative and significant sign of PCPHO coefficient confirms this hypothesis. However, it is expected that as the rental component increases the demand for mortgage funds should rise, but the coefficient of PCPR is negative and significant. SHELTY which is the difference between the percentage change in the home ownership index and the percentage change in the CPI has the expected positive sign, but is not significant.

As the number of households increase the demand for mortgage funds should also rise, since the demand for all forms of housing should also increase. The coefficient of the number of households, HH, is positive

and significant, as expected. The time variable indicates that there has been an upward trend in the amount of mortgages made over the time period 1973 to 1978. The coefficient of the lagged stock of mortgages, LM, is very small, indicating a very slow adjustment process.

The results of the estimates of the two formulations of the model are generally the same. Only the price variables seem to have different effects in the two formulations. The dual nature of a house both as a consumer good and as an asset may explain the problems with the price variables. As a purchaser of housing services the quantity demanded of housing should be inversely related to the price. However, as a demander of a house as an asset your demand may increase as prices rise if you view current price changes as a reasonable proxy for the return on your house as an asset. Thus, the changes in the homeownership component of the CPI may have an indeterminant effect on the demand for houses and hence the derived demand for mortgage funds.

VI. Summary and Conclusions

All of the terms of the mortgage--the effective yield (which includes both the contract rate and the loan initiation fees and charges), the amount of the loan, the loan to value ratio and the maturity of the loan--should have an impact on the cost and the desirability of a mortgage loan to the borrower. In this paper two different specifications of the terms are used to test the sensitivity of mortgage loan demand to changes in the terms of the mortgage. In the first specification the individual terms are entered directly into the equation. The estimates of this equation indicate that borrowers are sensitive to the effective rate, the loan amount and the maturity; however, the loan to value ratio had no significant impact.

In the alternative formulation the terms of the mortgage were used to compute the implied down payment and monthly payment. This version of the model is intuitively appealing since it would seem that the individual borrower of funds is most concerned with the dollar amount he will have to spend to get into the house and the amount he will have to pay each month to stay there. The estimates indicate that borrowers do, in fact, look at the down payment and the monthly payment in making their borrowing decisions. Both of these variables have the expected negative impact on mortgage borrowing.

Past studies have attempted to include the terms of the mortgage loan in estimates of the demand for residential mortgage funds but in general these attempts have not been successful. No significant impact of the terms other than the contract rate have been found. In this paper, the results indicate that borrowers do look at all of the terms of the mortgage.

The question of whether or not borrowers consider non-contract rate terms of the mortgage in making their loan decisions is more than an interesting theoretical question. In making policy decision which will affect the mortgage market both the Federal Reserve and the Federal Home Loan Bank need to understand clearly the workings of this market. Models which measure the impact of monetary policy on the housing sector by looking at the contract rate alone may be seriously misspecified. The results of this study imply that to make policy decisions based on the assumption that only the contract rate matters, ignoring the other terms, is to exclude information that demanders of mortgage funds consider significant in making their borrowing decisions.

NOTES

¹For fuller discussion of the theory of mortgage demand see Guttentag [2], pages 219-222.

²Studies by Jung [6], Sandor and Sosin [11] and Page [10] found that movements in interest rates and non-price terms of the loan tended to reinforce each other resulting in either increases or decreases in mortgage lending and credit availability but it is impossible to determine from these studies whether the change is borrower or lender induced.

³A number of studies, however, have found some evidence that lenders do ration credit by systematically varying the non-price terms of the loan contract. See Sealy [12], Ostas [9], and Zumpano and Rudolph [14]. Unfortunately these studies shed little light on how borrowers respond to changing credit conditions.

⁴Examination of the latent roots and latent vectors of the correlation matrix is a much more precise method of detecting the presence of multicollinearity. If one or more of the latent roots is very small (near zero), then multicollinearity is present. The source (S) of the multicollinearity can be ascertained by examining the elements in the latent vectors associated with very small latent roots.

⁵For more detailed information on principal component regression analysis, see E. R. Mansfield, J. T. Webster and R. F. Gunst [9].

⁶The critical latent root value used in the PCR regression reported in this study is .13 for equation 1 and .02 for equation 2.

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