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POOLED REGRESSION ANALYSIS OF INNER CITY MORTGAGE LOAN FLOWS*

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Introduction

During the decade of the 1970's, questions had been raised concerning the effects of neighborhood racial composition and structural age characteristics on the flow of mortgage loans. These concerns have been collectively referred to as the problem of redlining. A number of studies were done to ascertain the relationship between these neighborhood characteristics and the availability of mortgage credit. The problem with many of these early studies [5, 7] was that they relied on relatively unsophisticated statistical methodologies. Later studies such as those by Ahlbrandt [1], Benston [3], and the authors [8] utilized more sophisticated techniques but suffered from the problem that they lacked generality since they usually were case studies of individual cities. In this article, a more general approach is attempted to help alleviate some of these earlier problems.

The purposes of this article are twofold. First, the effects of the racial composition and structural age of a neighborhood will be examined. Second, the methodological problems encountered in differentiating loan supply influences from loan demand influences will be discussed and the policy implications of the study summarized. A special statistical characteristic of the study is the pooling of information collected over eight midwestern SMSAs. The data were pooled in order to determine whether generalizations concerning loan restriction behavior can be made across cities.

Conceptually, the study treats each SMSA's census tracts as separate "neighborhoods" each having individual mortgage loan markets including individual demand and supply schedules for mortgage funds. The statistical procedure regresses mortgage loan flows on a neighborhood's racial composition and structural age as well as other variables controlling for supply and demand influences. Two pooled regression experiments are conducted. In the first, each SMSA has its own intercept dummy variable but all of the regressors, including race, are constrained to have the same effect (coefficient) across SMSAs. In the second experiment each SMSA has its own intercept dummy variable and an interactive (slope) dummy variable. These slope dummies allow the effect of race on loan flows to vary across SMSAs. The remaining regressors, including neighborhood age, are constrained to have the same effect on loan flows across SMSAs. By allowing race to take on varying coefficients across SMSAs it is possible to observe whether the effects of racial composition on loan flows are statistically significant in each SMSA, or whether it is reasonable to treat the cities as a single sample.

The remainder of the paper is organized into several sections. In the next section the model on which the statistical results are based is presented. The data sources and statistical methodology are presented in the third section, followed by a discussion of the empirical results. In the final section, the methodological

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problems encountered with respect to the identification problem are discussed, and the study's policy implications are summarized. Throughout the paper neighborhood racial composition and age are referred to as "socially sensitive" variables.

THE MODEL

A. Glossary of Variables

1. Dependent Variable

NLOANS = number of conventional 1-4 family owner-occupant mortgage loans made by Savings and Loans (S&L's) and Commercial Banks (CBs), plus FHA loans made by all lenders in census tract t

2. Independent Variables Included in the Models

HSTOCK = number of 1-4 family dwellings (housing stock) in census tract t

ED = median years of education

DUR = weighted average duration of residence

Y = median income

PV70 = median property value

i = effective interest rate on loans

PDPV = percentage change in median property value

MUNEMP = unemployment rate among males

AS = weighted average age of structures

BLK70 = percentage of the population which is black

3. Alternative Form of Racial Variable Used in the Empirical Analysis

DUM3 = 1 if BLK70 is greater than the pooled mean value of BLK70, zero otherwise

4. Intercept Dummies Used in Pooled Regressions

DCANTON = 1 if Canton, zero otherwise
DCINCY = 1 if Cincinnati, zero otherwise
DCLEVE = 1 if Cleveland, zero otherwise
DDAYTON = 1 if Dayton, zero otherwise
DFWAYNE = 1 if Fort Wayne, zero otherwise
DINDY = 1 if Indianapolis, zero otherwise
DTOL = 1 if Toledo, zero otherwise

5. Slope Dummies Used in Pooled Regressions

Slope dummies for racial composition were formed by multiplying the appropriate intercept dummies by the race variables. In the following list of variables, the blank space indicates that the proper city code should be inserted. The city codes are as follows:

CAN = Canton
CLE = Cleveland
WAY = Fort Wayne
LIM = Lima
CIN = Cincinnati
DAY = Dayton
IND = Indianapolis
TOL = Toledo

D×DUM3 = appropriate intercept dummy multiplied by DUM3

B. The NLOANS Model

1. $DLOANS = DLOANS\ (\overset{+}{HSTOCK}, \overset{+}{ED}, \overset{-}{DUR}, \overset{+}{Y}, \overset{-}{PV70}, \overset{-}{i})$

2. $SLOANS = SLOANS\ (\overset{+}{i}; \overset{+}{HSTOCK}, \overset{+}{Y}, \overset{+}{PDPV}, \overset{-}{MUNEMP}, \overset{-}{AS}, \overset{-\mp}{BLK70})$

3. $NLOANS = DLOANS = SLOANS$

4. $NLOANS = NLOANS\ (\overset{+}{HSTOCK}, \overset{+}{ED}, \overset{-}{DUR}, \overset{+}{Y}, \overset{-}{PV70}, \overset{+}{PDPV}, \overset{-}{MUNEMP}, \overset{-}{AS}, \overset{-\mp}{BLK70})$

DLOANS = demand for 1-4 family owner occupant mortgage loans

SLOANS = supply of 1-4 owner family owner occupant mortgage loans

Equations 1-4 represent a supply-demand model for owner occupant mortgage credit by census tract. The model assumes that lenders are noncollusive profit maximizers subject to risk considerations and that households are noncollusive utility maximizers. The expected sign is contained above each variable.

Equation (1) specifies mortgage loan demand as a derived demand dependent on the number of houses being sold and consequently requiring financing. The number of houses being sold in a census tract is determined by the supply of houses put up for sale and the demand for housing in that census tract. The price of housing in the census tract is assumed to clear the market for housing thereby dropping it out of equation (1).

In equation (1) HSTOCK is expected to positively influence loan demand because it is expected to directly affect the supply of houses put up for sale. This follows from the assumption that the number of housing units placed on the market each time period is proportional to the housing stock. The current propensity of residents of the census tract to move, and thus put their houses up for sale, is assumed to be positively influenced by ED based on migration studies which suggest that the higher the average education of a population, the higher the mobility of that population.[1] Thus, ED is thought to have a positive effect on DLOANS. The current propensity to move is thought to be inversely related to DUR because of communal ties developed over time which discourage movement, and because households with long duration of residency may have contracted their mortgage loans at lower interest rates prevalent in the past. This could cause a reluctance to move at the present time during a period of higher mortgage rates. Consequently, an inverse relationship is posited to exist between DUR and DLOANS.

The demand for housing in the census tract, and thus the derived demand for mortgage loans, is directly influenced by the income of those seeking to purchase housing in the census tract. On the assumption that people move into neighborhoods in which residents have incomes similar to their own, Y is assumed to act as a proxy for the income of the potential house buyers. This suggests that Y is directly related to DLOANS since the higher the income of the potential buyers the more capable they are of purchasing the housing in that census tract. Given Y, the greater the property value of housing (PV70) in a census tract, the smaller the

[1] For example, see Blau and Duncan [4] and the U. S. Department of Commerce [10].

potential number of borrowers who can afford the property. This leads to the negative sign posited between PV70 and DLOANS. Finally, i is thought to negatively affect DLOANS as reflected by the negative sign in equation (1).

Equation (2) is the loan supply equation. It assumes a normal price - quantity supplied relationship in which i and SLOANS are expected to be directly related. HSTOCK is expected to directly affect the supply of loans in proportion to a census tract's size.

Risks due to borrower and collateral characteristics as perceived by the lenders are implicitly included in equation (2) and are expected to have a negative impact on SLOANS. Any factors having a positive influence on perceived borrower or collateral risk will have a negative effect on SLOANS. Factors inversely related to perceived borrower and collateral risk will have a positive impact on SLOANS.

Lenders' perceptions of borrower risk are assumed to be inversely related to Y on the basis that the greater the borrower's income, the less chance of loan delinquency and default. It follows that Y will be positively related to SLOANS. Y is also expected to affect collateral risk for the lenders. Low income levels may be perceived by lenders to lead to inadequate property maintenance and to declining property values. The result is that housing collateral in such neighborhoods may carry more risk than usual which reinforces the positive sign for Y in equation (2).

There are two hypotheses concerning the effect of a census tract's racial composition (BLK70) on SLOANS which are considered. First, the racial composition of the population currently living in the census tract is assumed to reflect the racial composition of those groups attempting to borrow money to move into the tract. On this basis BLK70 may be expected to possess a negative value in equation (2) because of the increased uncertainty attendant with blacks' future income streams due to their greater incidence of unemployment. This uncertain income stream could also affect lenders' perceptions of collateral risk if they believe it could lead to uncertain property maintenance and property values. This would result in the perception that housing collateral in black neighborhoods may cause higher risk and would reinforce the negative sign for BLK70. Based on this rationale, a negative sign is indicated above BLK70 in equation (2).

An alternative hypothesis concerning racial compotition is that integrated neighborhoods may cause considerable collateral risk apprehension on the part of the lenders because of the chance of such neighborhoods rapidly becoming all black, causing possible volatility of property values. This consideration has been referred to in other studies in conjunction with the "tipping point" argument [6]. According to this argument, after some critical value has been reached for the percentage of a neighborhood which is black, white flight begins to accelerate due to a self-fulfilling prophecy that the neighborhood will soon become all black. Once such a neighborhood reaches a high composition of blacks the neighborhood is thought to become stable again because white reentry is considered unlikely.

Consideration of the dynamics of neighborhood racial composition in this fashion suggests that lenders perceive racially heterogeneous neighborhoods as being riskier areas in which to lend than racially homogeneous areas. This rationale suggests a u-shaped relationship between the percentage of a neighborhood's population which is black and the number of loans transacted in that neighborhood. Such a relationship could be expressed as a quadratic functional form using BLK70 and its square (BLKSQ) as regressors, and hypothesizing a negative sign for BLK70 and a positive sign for BLKSQ. This hypothesis accounts for the negative - positive sign pattern expressed above BLK70 in equation (2).

The three remaining variables in equation (2) are included because they also affect lenders' perceptions of collateral risk and willingness to supply credit. First, AS is expected to be directly related to the lenders' perceived risk. As housing units become older, their future rate of appreciation becomes lower and more uncertain because of increasing maintenance expenditures and the increasing unpredictability of such expenditures. In addition, possible obsolescence caused by changes in tastes and/or technological factors causes risk to rise with AS. This is expected to be true not only as it applies to the age characteristic of a single house but also to those of a neighborhood. Consequently, AS is expected to be positively related to risk and inversely related to SLOANS. Second, it is assumed that the lenders will perceive collateral risk to be inversely related to PDPV because property value changes would be expected to continue into the future. Therefore, PDPV is expected to have a positive impact in equation (2). Third, it is expected that a high rate of unemployment in the census tract would be perceived as decreasing the chance of good property maintenance and increasing the possibility of crime. Both effects of unemployment increase collateral risk in the census tract due to concerns over future property values and imply that MUNEMP carries a negative sign in equation (2).

Equation (3) defines the equilibrium condition in the model. Equation (4) is the reduced form expression for total loans transacted (NLOANS) in any census tract and represents the equation to be estimated since the necessary interest rate transformation is not available to estimate SLOANS. This reduced form equation reflects the complete general model and the signs associated with each variable in the reduced form follow from the preceding discussion. Each variable either has the same sign in the demand and supply equations, or appears only in the demand or supply equation. Given this structural specification the reduced form coefficients' signs are unambiguously determined. Moreover, given this structural specification the signs of the estimated coefficients of the socially sensitive race and age of structure variables would represent the loan supply response to these factors.

Data and Methodology

The data used in this study were obtained from three major sources. Data describing each census tract's socio-economic and housing stock characteristics were collected for each of the eight SMSAs. This information was taken from the *1970 Census of Population and Housing* and the *1960 Census of Population and Housing.* There was some concern about using 1970 census tract data to approximate 1977 census tract characteristics. This was particularly true for the composition of each tract as measured by percent black in 1970. Attempts to obtain updated estimates of the racial composition as well as other variables were undertaken but they were not successful. In addition, adjustments to the 1960 and 1970 data were necessary to put the census tract data in a useful form.

Loan data were obtained from two different sources. First, federal loan disclosure statements were collected from individual lending institutions which were either federally chartered or which were covered by federal deposit insurance. In addition, for the SMSAs in Ohio, state disclosure reports were available for the first three quarters of 1977. These provided information on institutions in Ohio not covered by the federal disclosure law. Data on FHA insured loans obtained from the FHA were also used because interviews with lenders in the eight SMSAs clearly indicated that a compilation of just the disclosure statements would omit a substantial portion of government insured loans. This is due to the fact that in

many SMSAs most insured loans are originated by mortgage bankers who are not required to file loan disclosure reports. Unfortunately, similar information was not available for VA insured loans because the Veterans Administration has not yet computerized its loan data files.

The statistical analysis involved the estimation of a set of pooled multiple regression equations. Each of the equations estimated in the study is a reduced form equation derived from the underlying structural demand and supply model discussed previously. Based on this fact and the assumption that the equation error terms were normally distributed independent random variables with zero means and constant variances, the method of ordinary least squares was used to estimate the parameters of the models. The significance of individual coefficients and sets of regressors were tested using standard t and F tests.

The pooling procedure treats the data collected from the various cities as a single large sample and thereby increases the degrees of freedom associated with the sample. In addition, the probability of observing independent movement among the control variables is increased which should help reduce collinearity among the regressors. While pooling the data offers certain advantages over the individual city equations in terms of degrees of freedom, it leads to a more constrained analysis. In particular, it constrains any variable's coefficient to be equal across SMSAs. This limitation can be mitigated through the used of appropriate dummy variables to measure separate SMSA effects. Initially, a set of intercept dummies was included in the estimated equation. This was done to account for the individual SMSA effect associated with each city. The procedure helps eliminate heteroscedasticity due to different city size and helps prevent specification bias in the remaining coefficient estimates. Eight dichotomous dummies were included in such a way that the coefficient of each dummy represents the estimated intercept term for that city. The associated t statistic for each intercept dummy indicates whether the city's intercept term is significantly different from zero.

A second equation contains intercept and slope dummies. Eight slope dummies are included in the equation. The dummies are defined in such a way that their coefficients measure the impacts of each city's racial variable on the dependent variables. Their t statistics test whether individual SMSA racial variables are significantly different from zero when the coefficients of the control variables are constrained to be equal across cities. The intercept dummies are again included to control for heteroscedasticity and specification bias.

Empirical Results

Pooled Regressions with Intercept Dummies. Table 1 contains the pooled results for the NLOANS in which the set of intercept dummies is included. The model was estimated in log-linear form. Its rationale is based on the assumption that mortgage loan risk is inherently an interactive phenomenon in which the marginal impact of each independent variable depends on the level of the other independent variables. The functional form of the log-linear model in which $Y = AX_1^{\alpha 1} X_2^{\alpha 2} \ldots X_n^{\alpha n}$ allows for this type of interaction effect.

In regard to the socially sensitive variables, the effect of race is measured by the use of a dummy variable (DUM3). It is designed to test whether there is a stepwise or "threshold" effect on the number of loans made between tracts whose proportion of blacks is below the mean of the combined eight SMSAs and those where it

TABLE 1. Pooled Regression Results for the NLOANS Model: Intercept Dummies

D.V.: FN FORM:	NLOANS LOG	D.V.: FN FORM:	NLOANS LOG
HSTOCK	1.348 (20.68)*	DCANTON	-1.980 (-3.09)*
ED	3.246 (5.26)*	DCINCY	-2.230 (-3.47)*
DUR	-0.059 (-0.29)	DCLEVE	-2.384 (-3.69)*
Y	1.017 (4.03)*	DDAYTON	-2.483 (-3.85)*
PV70	-1.120 (-4.66)*	DFWAYNE	-2.428 (-3.78)*
PDPV	0.116 (4.75)*	DINDY	-3.036 (-4.82)*
MUNEMP	-0.061 (-2.35)*	DLIMA	-1.953 (-2.96)*
AS	-1.045 (-7.35)*	DTOL	-8.567 (-12.21)*
DUM3	-0.916 (-8.65)*	R^2	0.882
		# OF TRACTS	1201

NOTE: t statistics in parentheses
* indicates significance at .05 level (two-tailed).

is above the mean.[2] Its underlying rationale is that lenders may act in an either-or fashion based on their perception of whether a tract has a high or low concentration of black residents. The results in Table 1 show that DUM3 is negative and significant indicating that tracts with a proportion of blacks greater than 16.3 percent receive significantly fewer total loans than other tracts. AS, the other socially sensitive variable, also has a negative effect on the flow of total mortgage loans by census tract. The results indicate that the elasticity of total loans with respect to AS is −1.045.

The control variables all exhibited the expected sign and only DUR was not statistically significant. All of the intercept dummies were significant, but they contain no inherent economics implications.

Pooled Regression Results with Intercept and Slope Dummies. Table 2 contains the pooled regression results which include both intercept and slope dummies. As in the previous case, the model is estimated in log-linear form. The racial effect is also the same as appeared in the intercept dummy counterpart. In this model it is denoted as D×DUM3, where the blank indicates the appropriate city code. Therefore the only difference between the results analyzed in Table 1 and

[2] Other racial variables capable of testing for a u-shaped relationship between BLK70 and NLOANS were also examined, but DUM3 seemed to provide the most explanatory power.

TABLE 2. Pooled Regression Results for the NLOANS Model: Intercept and Slope Dummies

D.V.: FN FORM:	NLOANS LOG	D.V.: FN FORM:	NLOANS LOG
HSTOCK	1.356 (20.86)*	DCANTON	-1.800 (-2.80)*
ED	3.577 (5.78)*	DCINCY	-2.068 (-3.23)*
DUR	-0.122 (-0.59)	DCLEVE	-1.987 (-3.08)*
Y	0.868 (3.36)*	DDAYTON	-2.276 (-3.53)*
PV70	-1.087 (-4.43)*	DFWAYNE	-2.266 (-3.53)*
PDPV	0.121 (4.90)*	DINDY	-2.839 (-4.50)*
MUNEMP	-0.058 (-2.24)*	DLIMA	-1.870 (-2.82)*
AS	-1.005 (-7.06)*	DTOL	-8.363 (-11.93)*
DCANDUM3	-0.398 (-0.95)	R^2	0.884
DCINDUM3	-0.615 (-2.75)*	# OF TRACTS	1201
DCLEDUM3	-1.494 (-9.04)*		
DDAYDUM3	-0.704 (-2.41)*		
DWAYDUM3	-0.258 (-0.54)		
DINDDUM3	-0.720 (-3.28)*		
DLIMDUM3	0.353 (0.55)		
DTOLDUM3	-0.798 (-2.58)*		

NOTE: t statistics in parentheses
* indicates significance at .05 level (two tailed).

those contained in Table 2 is that the latter do not constrain the effects of racial composition to be equal across cities.

In examining the slope dummies for racial composition, individual city effects become evident. It should be recalled that when the effect of racial composition was constrained to be equal across cities, DUM3 had a negative and significant effect on NLOANS. Examining the coefficients of the various D×DUM3 variables in Table 2 shows that the effect of racial composition on NLOANS differs by city. In particular, in five of the eight cities (Cincinnati, Cleveland, Dayton, Indianapolis, and Toledo) D×DUM3 is significantly negative. Again this indicates that census tracts in these cities whose percentage black exceeds the pooled mean 16.3 percent receive significantly fewer loans than other tracts in those cities. In Canton,

Fort Wayne, and Lima there is no statistically significant difference in the number of loans going to individual census tracts on the basis of whether the tract contains a proportion of blacks greater than or less than the pooled mean.

Not unexpectedly, the effect of AS on NLOANS is the same as in the previous model. The average age of structures in a census tract is significantly and negatively related to NLOANS. For every one percent increase in the average age of structures there is approximately a one percent reduction in the number of loans going to that tract. The control variables again have the hypothesized signs and, with the exception of DUR, all are significant.

In summary, when the socially sensitive variables are constrained to be the same across all cities, both race (as measured by DUM3) and age of structures exhibit a significant negative effect on loans. However when the impact of each city's racial variable on NLOANS is allowed to vary from city to city the results are mixed. This suggests that there are significant city differences that need to be recognized. The control variables are generally significant and exhibit the expected sign pattern over both forms of the estimated model.

Methodological Issues and Policy Opinions

The Identification Problem. Since the research project on which this paper is based was initiated, several questions have been raised concerning the underlying methodology employed in the analysis. The most crucial of these points concerns the identification problem and its relationship to estimating a reduced form equation. It is imperative to address this identification question in order to properly assess the results of the research.

The main point of this identification problem argument involves the implicit demand and supply models underlying the estimated reduced form equations. The rationale behind the model suggests that the socially sensitive racial composition and age of structures variables appear as arguments only in the supply equation. Based on this reasoning, the signs of these variables in the reduced form equation are uniquely determined and can be uniquely related to supply influences. Therefore, the signs and significance of the coefficients of the socially sensitive variables in the estimated reduced form equations can be analyzed to determine if they are consistent with an underlying supply restriction behavior. The central point of the identification problem argument is that the socially sensitive variables should also appear in the loan demand equations. This notion is based on the logic that the socially sensitive variables have a negative effect on *housing* demand, reduce housing turnover, and therefore have a negative impact on *loan* demand. Consequently, the argument suggests that the signs of these variables in the reduced form equation cannot be uniquely attributed to supply, and the estimated coefficients of the socially sensitive variables reveal nothing about loan supply behavior.

There are several ways of addressing this problem. The first is to merely assume that the socially sensitive variables do no affect the demand for loans in a census tract. Although this approach is simple, it is also very simplistic and is unsatisfactory as a response. A second approach is to assume that the institutionally bred caution of lenders outweighs the caution of individual households which may be based on less experience and less access to accurate information. Under this approach, the estimated coefficients of the socially sensitive variables can be largely attributed to supply effects even though they may contain elements of

demand impacts. In this way, it is at least possible to gain some information concerning the general nature of the supply response form coefficients. Although somewhat more satisfactory than the first approach, it too is flawed since the reduced form impact could not be uniquely attributed to supply factors.

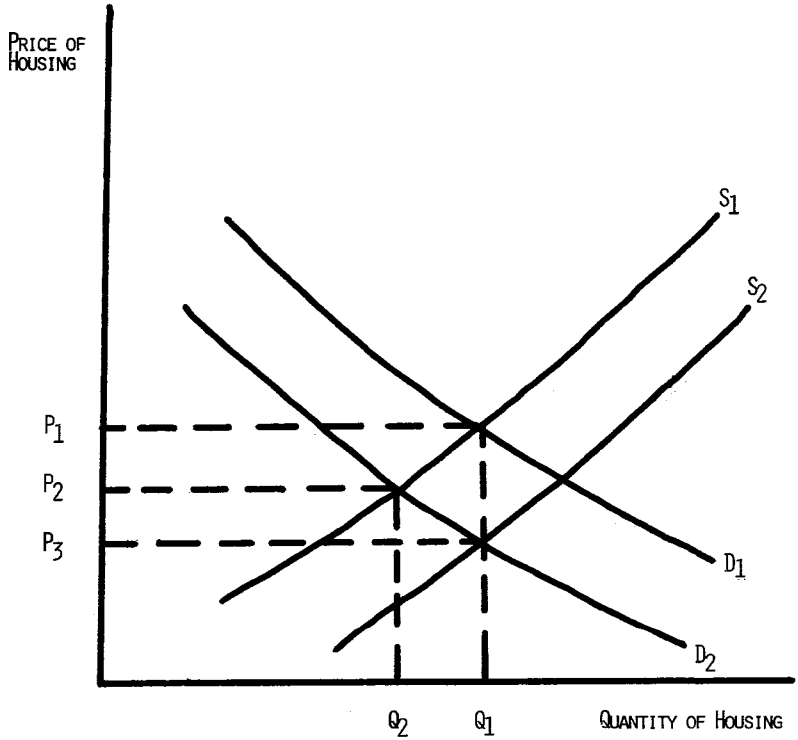
The third approach to the problem is more palatable, and we feel that it provides sufficient justification for the reduced form methodology employed in this study. This approach takes the argument that socially sensitive variables affect *housing* demand as valid. Under this assumption, the socially sensitive variables would act as shift variables and shift the demand for housing to the left. Figure 1 illustrates this shift. Assume that D_1 and S_1 represent the demand and supply of housing in a census tract before accounting for the socially sensitive variables. Based on these demands and supply curves, housing commands a market price of P_1 and the quantity of housing exchanged (i.e., housing turnover) is Q_1. Demand curve D_2 represents the demand for housing in the tract after accounting for the presence of the socially sensitive variables. In the absence of any supply shift, the reduced demand results in a lower price (P_2) and lower housing turnover (Q_2). Since housing turnover is a primary determinant of loan demand, this would result in a lower loan demand in the neighborhood due to the presence of the socially sensitive variables. Consequently, it is argued, the socially sensitive variables should appear as independent variables in the loan demand equation, and the signs of these variables in the reduced form equations cannot be uniquely attributed to loan supply behavior.

However, if it is valid to argue that socially sensitive variables have a large enough effect on individual households to shift the demand for housing in a tract to the left, then they should also have a large enough effect on the households already living in the tract to induce them to desire to leave. This would shift the supply of housing in the tract to the right. In the absence of any quantitative evidence concerning the relative sizes of these shifts, and given that the effects are both on individual households, it is reasonable to assume that the shifts in demand and supply for housing would be relatively equal. Supply curve S_2 in Figure 1 illustrates this compensating shift in the tract's supply of housing.

As illustrated in Figure 1, the combined effects of these shifts imply that the impact of the socially sensitive variables on the housing market would be reflected in a price reduction from P_1 to P_3. The quantity of housing exchanged in the tract, or the housing turnover in the tract, would be approximately equal to Q_1 before or after the shifts in demand and supply. It is this housing turnover which appears in the loan demand function. Since it is not affected by the combined shifts in demand and supply it is quite reasonable to assume that the socially sensitive variables have no effect on loan demand in spite of their effect on housing demand. In light of this argument, the reduced form coefficients of the socially sensitive variables in the loan model could be interpreted as supply responses, and the underlying methodology of this study would be valid.

An alternative method of dealing with the identification problem which has been suggested is to look at the loan terms by census tract rather than the number of loans. This would focus attention on the price response in the mortgage loan market rather than the quantity response. In this approach it is assumed that the supply of loans is perfectly elastic at a given set of loan terms (mortgage rate, down payment percentage, and maturity). Therefore, any significant worsening of loan terms to the borrower which is caused by the presence of socially sensitive

FIGURE 1. The Effect of Socially Sensitive Variables on the Demand and Supply of Housing.



variables can be attributable to a supply restriction. The absence of more stringent loan terms in the presence of the socially sensitive variables would be consistent with no supply restriction. However, this methodology also has some inherent problems. In particular, the assumption of a perfectly elastic supply curve in a census tract may be questioned. If this assumption is not accepted as reasonable, and a positively sloped supply curve is assumed instead, then this approach may not escape from an identification problem similar to that experience when focusing on loan quantities. It simply is not clear that the focus on loan terms yields more fruitful results than focusing on loan flows.

Another alternative approach to the problem of isolating a unique supply response is to use the rejection rate on loans by census tract as the dependent variable. Since the rejection rate embodies only supply factors, the problem of identification is avoided. Since some data necessary to compute rejection rates have been obtained as a result of this project, it may be possible to implement this approach in the near future. However, this methodology is also not totally without problems. In particular, the problem of pre-screening may arise. If applicants are pre-screened, then official rejection rates would not yield as rich a source of information as hoped. However, only by analyzing the data can a conclusion be reached concerning whether or not this is a fruitful approach.

Another approach which may be the most satisfactory is to estimate the loan supply function directly. The problem with implementing this approach is the

unavailability of loan data necessary to measure the "price" of mortgage loans. Fortunately, a sample of this data has been obtained in this project, and the direct estimation of the loan supply equation may be possible.

Policy Opinions. One apparent conclusion derived from the empirical results is that the effects of racial composition vary across cities. When its effect was constrained to be equal across cities, it was negative and highly significant. However, when its impact was allowed to vary across cities, it demonstrated a significant negative effect in five cases and was insignificant in three cases. In general, it appeared to be a significant determinant of loan flows in the larger cities but not in the smaller cities. Other statistical results not contained in this paper but which are reported elsewhere [9] analyze the cities separately. They support this notion that each city is different and should be treated as a separate case.[3] Therefore, it seems that any monolithic national policy attempting to mandate a similar pattern of response across cities may not be well advised. Instead, it would appear that any national policy directives which may be initiated should be implemented at a more local level where the unique aspects of each city's mortgage market can be considered.

Based on the underlying assumptions of the model, the negative effects attributed to race may be due to perceptions of higher risk by lenders. Therefore, a reasonable policy alternative may be to allow greater variation in loan terms across neighborhoods to compensate lenders for this greater perceived risk. If in fact the risk is higher, then the ability to charge a higher price to compensate for the additional risk would have desirable effects on loan flows in these neighborhoods. If the actual risk is not higher in these tracts and is merely an unwarranted perception by some lenders, then the working of a competitive loan market will eliminate the unwarranted price premium. Certainly this latter result depends on the assumption that the loan markets are competitive. Although no evidence to the contrary was established during this study, a logical companion policy to allowing greater variability in loan terms would be to take steps to increase the degree of competitiveness in the urban mortgage markets. It should also be pointed out that this evidence of a greater perceived risk in some of the black and racially mixed neighborhoods is supported by some recent work by Barth, Cordes, and Yezer [2]. In their analysis they found that certain racial and property condition characteristics were associated with higher risk of default.

An alternative approach to allowing greater variability in loan terms to compensate for additional risk is the strategy of attempting to lower the risk of lending in black and racially mixed neighborhoods. Unfortunately this approach has a certain "catch-22" aspect to it. That is, the reduction of risk for lenders may become part of the problem rather than a solution to the problem. For example, part of the redlining controversy centers on the use of FHA loans in black and older neighborhoods. From one perspective, FHA loans can be viewed as carrying the "risk lowering" strategy to its extreme by totally eliminating risk for the lender. Yet the mere presence of FHA loans in a neighborhood, it is argued, is a signal of a neighborhood in decline [11]. FHA loans may also suffer from the fact that lenders bear no risk, and consequently have less incentive to exercise careful judgment

[3] These results analyze different types of loans, different functional forms, different measures of racial composition, and different types of lenders. The analysis is done for each city individually rather than pooling them as a single example. The results of this analysis underlie and reemphasize some of the policy opinions expressed in this section.

on the allocation of such loans. This can also become part of the problem if it results in greater loan default.

Therefore, it would seem that any risk reduction strategy could only be successful if it avoided the pitfalls of FHA loans. First, it would require an invisibility to appraisers and real estate agents appraising other properties in the neighborhood. Second, at best it would have to consist of a partial subsidy to lenders so that they still would bear enough risk to ensure careful scrutiny and judgment in the allocation of loans. However, even if a program containing these aspects could be designed, it still would be less favorable than allowing greater variability in loan terms. In that case a competitive loan market would exert downward pressure on loan terms if the initial perception of higher risk were not true in reality. Under that situation a competitive market would eliminate the price premium received by the lenders. Under the risk reduction or subsidy, the perception of higher risk which was not valid in fact would result in a windfall for lenders or below market loan terms in subsidized neighborhoods. Neither of these results can be justified on an efficient resource allocation argument, and the subsidy scheme would seem to be less preferred than the loan term variability scheme accompanied by the controlling effect of competition.

Another possible solution which we do not favor is a credit allocation scheme. Part of our disdain for this approach results from our predilection as economists to prefer market solutions. However, the results of the analysis increase our unwillingness to accept the allocation solution. In particular, the empirical results (including some not reported here [9]) strongly suggest that the effects of racial composition are different for each city, each type of loan, and each type of lender. In light of this it seems that any policy which is adopted must be flexible enough to deal with many different and perhaps rapidly changing situations. The inertia inherent in any set of allocation rules would remove the very flexibility necessary to adequately deal with the problem. Obviously the process of neighborhood change is a dynamic problem. To deal with the problematical aspects of neighborhood change requires policies and mechanisms which can react quickly and efficiently to rapidly changing sets of market signals. The establishment of any sort of rigid credit allocation rules would seem an ill suited method of dealing with this type of problem.

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